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FRENCH CUSTOMS GUARDS AND FRENCH SMUGGLERS.

THE economic administration of France, recently transformed in the direction of protection, is synthesized, so to speak, in two categories of men—the smuggler, that scourge of the frontier, and the customs guard, his eternal enemy.

Let us first speak of the customs guard. Like nature itself, his uniform juxtaposes two colors that an old proverb declares to be irreconcilable—green and blue: a green jacket with red edging, a cap of the same color and trousers and overcoat of a bluish gray.

In order to become a customs guard, it is necessary to be an old soldier, to be able to exhibit a clean military record and to possess muscles capable of bending the bow of Diomede. Yet he is then but a candidate, the first year of service being a simple trial, at the expiration of which he is mercilessly discharged if he has not proved that he can combine the resolution of a Zouave with the sobriety of a Mussulman and the patience of a Mohican with the continence of a Carthusian. His probation having proved satisfactory, he is admitted to the honor of figuring on the master roll, and then forms part of one of the thirty-eight customs battalions of the French army; for the customs guard is not only a gabeler, but also a soldier, who in time of war is called upon to perform the rôle of guide and flanker. He is the advance guard and suffers the first fire. In the East, for example, it is the customs stations that, at the opening of hostilities, are charged with the defense of the bridges and tunnels, with the mission of blowing them up if need be, with the guarding of the telegraphs and railways, with the maintaining of communications, etc.

There are two categories of guards: the coast guard and the frontier guard. The life and habits of the one are very different from those of the other. But it is not with the first that we have to do here; it is with his colleague, the customs guard of the frontier—the entirely conventional frontier of the North, which no mountain or river separates from the national territory. He passes his life, day and night, in ambuscade or in expeditions into the fields and woods, in sunshine, rain or snow. It often happens that, when there has been a great storm of wind, an entire month passes without the faithful gabeler having slept for a single time in his bed. He has been squatting somewhere with his companion in his sheep skin bag, under the starry sky or in a glacial rain, his eye open upon the immense plain, watching the horizon; for these guards always go in couples, sometimes in threes, but rarely more. They carry upon their backs their entire camping material, consisting of a folding frame of wood, a long sheep skin bag and their weapons, which are an ordnance revolver and a hooked lance. With very rare exceptions, the latter is the only weapon that is employed, for it is the rule that a frontier guard must allow himself to be three quarters killed before using his offensive arms against the bandits whom he is commissioned to seize.

CUSTOMS GUARDS STARTING FOR AN AMBUSCADE.

GUARDS ON THE WATCH.

Each has with him, moreover, a companion of a different species, a dog—a large, strong animal built for racing and fighting, and that scents fraud with an extraordinary intelligence.

At nightfall our four expeditionists leave the barracks, equipped from head to foot, and proceed to the post assigned to them, which is now in an open field, now at the back of a road, now at a crossing of pathways and now at the edge of a wood. Here the men install their wooden frames and spread out their bags, into which they enter up to the shoulders, the dogs squatting at their side. They watch and sleep alternately. When the keen sense of the dog perceives some unusual odor or murmur, the intelligent animal takes good care not to growl, but pushes his master with his nose or paw in order to attract his attention. The sentinel noiselessly rises in his camp bed, his eyes search the dark field, he strains his ear and all his superexcited faculties are directed toward a single object, like those of a savage upon the watch. Shadows are delineated in the darkness: one, two, three, walking in a wide triangle so as to be able to scatter at the least warning, or else an entire troop advancing in Indian file, one in the footsteps of another, so as to leave but a single imprint. The guard then awakens his companion by touching him with the hand, and both rush forward upon a sudden, and the pursuit begins. The chase may last a long time if the smuggler is far ahead. Upon the point of being seized, he drops his load so that he can run with greater speed. Often, too, there occurs the chance of a battle, which almost always takes place when the number of the pursued is greater than that of the pursuers. The blows fall thick and fast, for the smuggler knows that his liberty is at stake, and he stops at nothing. The customs guard, on the contrary, restrained by his orders, employs only his natural weapons. One does not hesitate to strike with all his might, even to kill, while the other wishes only to capture and bind, without wounding. Finally, strength failing and nearly beaten to death, the guard, without releasing his hold, succeeds in disengaging his revolver, which he fires into the air, as much to intimidate his enemies as to call his friends. A neighboring post comes to his aid and then all is up. The prisoners are bound and led to the guard house and the conquerors hobble away to have their wounds dressed and to mend their uniforms. It sometimes happens, however, that things do not become tragic, and that the smuggler surrenders without striking a blow. Sometimes, too, the band consists of children, who, at the sight of a uniform, scatter in all directions. The guards, then being obliged to hold back their dogs and with but one hand free, are content to capture two or three,

At the customs stations or offices permanently established at points where the roads and rivers cross the frontier, the incidents are naturally very different from those that occur in the field. Here there are no ambuscades, and the guard has orders to inspect passers-by occasionally and vehicles and boats often. This service, as peaceful as it appears, has also its risks. As regards individuals, there is nothing to be feared. It is not through here that smugglers enter the frontier, and the people passing normally from country to country, having or not having a box of matches or a package of tobacco in the depths of their clothing, know

IN INDIAN FILE UPON A RAILWAY.

beforehand that they will be vaguely felt of, and offer no resistance to the operation. Neither are the boats accustomed to show themselves restive or threatening. It is the wagon alone that is sometimes to be feared. This Pandora's box presents itself under under two aspects—the pacific and the warlike.

In the first case, it stops of its own accord in front of the customs office in order to submit itself to inspection. Very different is the wagon of attack, which is a true machine of war, driven by rough fellows always ready to exchange blows and passing the frontier on a full gallop.

It is only in the regular and sedentary service of the ports and railway stations that the customs guard is relatively happy. There, at least, he escapes the wearing fatigue and the continual perils of the life of a scout led by his colleagues. These are residences much envied in this little world, but, unfortunately, to which there are not many elected. When he has succeeded, more or less lamed, but living, in passing through inclemencies, adventures and battles, and has reached his fifty-fifth year, the guard is allowed to request his right to be retired. The time of service of this soldier always on an expedition lasts, therefore, ten years

PURSUIT OF A SMUGGLER.

longer than the military service, which ends at the age of forty-five.

Smugglers are not what a vain people supposes them to be; or rather they are no longer so. That is to say, they are not the smugglers of fiction—honest outside of the exercise of their functions, passionately fond of their adventurous vocation, and even capable of chivalrous sentiments. Those who undertake smuggling as a business are careful, as a general thing, not to operate in person, all of them having at hand a large number of persons without the least prejudice. It is these persons, very different from the specialist of former times, that now infest the frontier and render the approaches almost uninhabitable, especially in the vicinity of the great manufacturing centers, such as Roubaix and Tourcoing. Scarcely a day passes in which the journals of Lille do not mention the assassination of laborers returning from their work, the violation of women in the fields or on the highway, the partial demolition of ale houses, bloody frays, and robbery everywhere. This is because certain hamlets of the two sides of the frontier have become the haunts of bandits and other criminals who find in smuggling the wherewithal to sustain their debauches. It is especially in these centers that the undertakers of smuggling recruit their forces. At a number of points of the frontier, on Belgian territory, there are intermediate establishments in which they engage and collect together the carriers that they are in need of.

The destination of the goods that have deceived the vigilance of the customs is extremely variable. Sometimes they are deposited in barns or deserted cottages, and sometimes, too, in a farm house or a tavern, whose owner shows himself obliging for fear of vengeance, but, in most cases, with trusty guardians or even with the corresponding dealer of the master smuggler and the one for whom the merchandise is intended. The tacit or paid for complicity of the frontier population greatly facilitates the operations of the smugglers. Certain of the latter are desperate men, endowed with as much energy as adroitness, devoid of all scruples and shrinking before nothing. No one is shielded from their malice in the villages, and the isolated farm houses, taverns and cottages are less protected still. The professional smuggler finds here, almost to a certainty, the obligingness, directions and refuge that are necessary to him, and he thus organizes a perfect system of halting places, depots and telegraphic communications that aid him in baffling the efforts of the customs. Here it is waving linen that is supposed to be drying in the wind, here it is a light that is shining or not shining, according to agreement, and here again it is a hammer that beats the anvil in such or such a way; all this speaks a language that is understood by him, all this is a warning or a signal to him. The expedition starts out or does not start out, and the band passes here or there according as the warners have declared the moment propitious or have revealed the absence or presence of an ambuscade.

Some of the principal master smugglers proceed by convoys and have a small body of horses at their disposal. After the expedition has accomplished its mission the horses are immediately distributed among the farms of the vicinity, where they are employed gratuitously in field work—an advantage to both the farmer and the smuggler. The horse is not the only auxiliary of the smuggler; there is another and much more valuable one—the dog, which serves him both as a speed impeller and a carrier.

The running smuggler attaches the animal to his belt by a leash long enough to prevent its interfering with his own motions, and thus pulled forward, his running reaches an extraordinary degree of rapidity.

As a carrier, the dog is employed in packs. A man pulled along by a dog directs the pack, each animal of which is provided with trappings containing the merchandise, and is armed with a collar bristling with iron spikes. Expeditions of this kind are made with a punctuality and discipline that would be exacted in vain of human smugglers.

There are also dogs that act as "skirmishers," that is to say, isolatedly and without whippers-in. These undergo a special training consisting in treating them badly in their Belgian domicile and overwhelming them with attention and good meals at the house of the French correspondent. After receiving their load, and being set loose with many cuffs, they proceed at full speed toward the place where they know that a feast awaits them; and the game is played. Every canine smuggler of this kind is slaughtered when seized, and the customs guard cuts off its right front paw as an evidence of conviction.

Along with the smuggling thus systematically organized, there is another and permanent kind that is still more difficult to suppress, and that is effected daily by the employes of the factories and exploitations in the vicinage of the frontier, and each of whom, man, woman and child, carries his little contingent of fraud—coffee, tobacco, petroleum, etc., which he proceeds to disburden himself of at some grocery store for a few sous in return. This is known to the customs

'A HAND TO HAND ENCOUNTER WITH SMUGGLERS.

people, but it is difficult to remedy the trouble. While half a dozen persons are under examination, hundreds of others are passing scot-free. A number of small retail grocers have no other suppliers than these casual and anonymous smugglers.

There are two other categories of frauds practiced upon the customs that may be called the personal and the commercial. The first, which is much the less important, is almost always effected by railway. Here again, it is necessary to distinguish between the occasional smuggler and the professional one. The latter, man or woman (for it is women in most cases who devote themselves to this sort of adventure), invariably employs the same means—specially prepared garments or double-bottomed valises. Now it is a gentleman who has substituted a lining of tobacco for his flannel waistcoat, or who, in a box simulating a book or an umbrella, or else in the depths of an ample mackintosh, carries either a hundred high priced Havana cigars or a stock of matches. Now it is a lady whose bustle is arranged like a closet or whose petticoats are like cartridge boxes.

The occasional smuggler is everybody. Among the thousands of travelers daily passing between Belgium and France, there is scarcely one who is not the possessor of a box of matches, a package of tobacco, or a few cigars. The Belgian matches are cheaper and better than the French, but the cigars are bad and the tobacco too.

However, it is not for any gain that these *corpus delicti* are brought home; it is through habit, for the "pleasure" of the thing, and sometimes also through mere fancy.

Commercial fraud is permanent and constitutes a sort of chronic complaint of the national finances and industries. It is effected at once by rail and wagon roads and waterways, either under the form of fallacious declarations or the secret introduction of prohibited or dutiable merchandise.

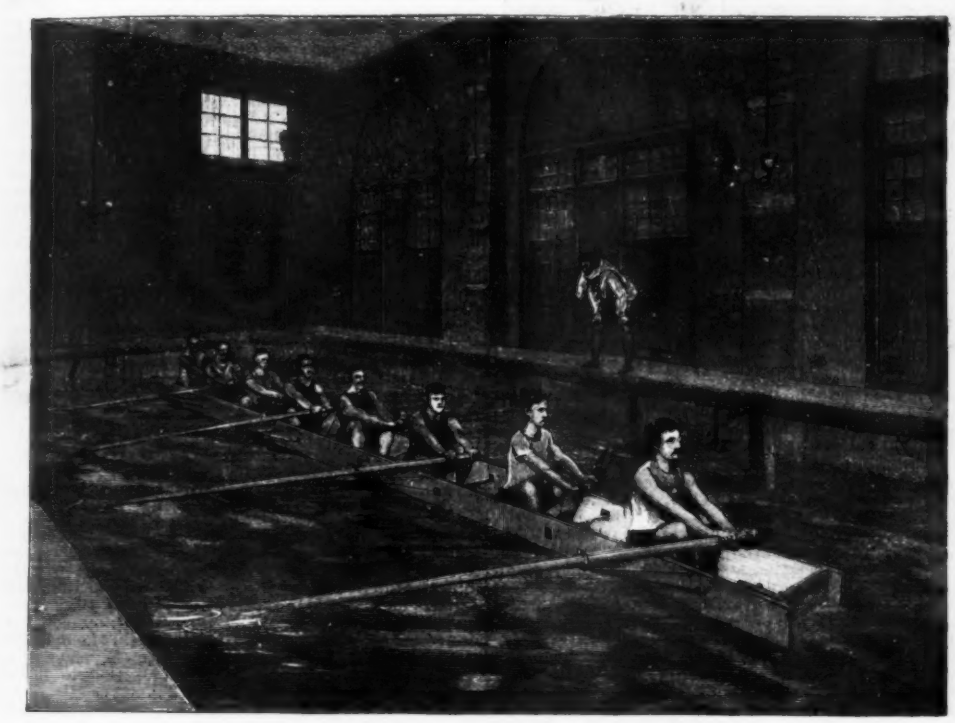
The extreme complication of the customs duties, the diversities of the taxes, and the difficulty presented by the discernment of the proportionality of the elements entering into the composition of manufactured pro-

ducts are so many causes to instigate and favor inaccurate declarations. It is naturally to the interest of importers or commission agents to pay as low a duty as possible, because both are benefited by the difference. If it is a question of textiles, deception is practiced in the numbering of the threads, or else fine threads, which pay a higher duty, are adroitly mixed with others in the same bale. If it is mixed fabrics, the lowest dutiable material is asserted to be dominant therein.

If it requires great experience on the part of the customs examiners to determine such classifications with accuracy, at least as much perspicacity is indispensable to baffle the ruses of occult importers. How suspect, for example, that the carcass of a horse has been eviscerated and then stuffed with some hundreds of pounds of tobacco; that blocks of stone or chimney brackets have been patiently hollowed out and converted into reservoirs of alcohol; that such or such a wagon has hollow shafts or wheels filled with contraband materials; that secret boxes have been established under the seats of such or such a car; that such or such a cart has double wheels; that cavities have been formed in such or such a locomotive, between the wheels and the cylinders or under the foot boards? The entire sagacity of the world would become powerless to triumph over such ingenuity did not the custom house have spies on the other side of the frontier, who keep it informed, and if, on another hand, there were no Judases among the smugglers, all ready to reveal the tricks in order to handle the reward offered to informers. Such tricks, continually varied and renewed, are too numerous to be cited here—so numerous, indeed, that a description of them would form a volume as bulky as a Greek dictionary.

WINTER TRAINING FOR THE BOAT RACE.

THERE are several things in this life pleasanter than practicing for the Inter-University boat race. Putting aside the glory, it is infinitely less enjoyable than



WINTER BOAT RACE TRAINING.

training for the May races, as the preparation for the great Easter race has to be gone through in the winter. The trial eights occupy November and the early part of December, and at neither university is the weather ever anything but abominable during these months. Then the eights are made up as early in January as the presidents can get their men together, and the opening months of the year are, as a rule, seasons to be remembered both at Oxford and Cambridge. Still, it is but seldom that the boats are stopped by the ice, and nothing short of a sharp frost ever prevents the coach from taking out his crew. In America, where winter is more regular in its habits, and according to all accounts, does not usually sandwich a spring day between two midwinter days, the crews practicing for the Yale and Harvard race take advantage of an excellent invention for securing open water even in the depth of winter. This device, as the illustration shows, is a large tank in which is moored the shell of a boat, so arranged that it gives under the strokes of the crew, but always returns to its original position as the men swing forward after each stroke. Of course, the men cannot lift their boat along as they do on a river, and the work is slightly different, as the pivot of leverage is the rowlock, and not the blade in the water, but the shifting of the power makes no difference to the crew, except that it makes the work a little heavier, while it enables them to practice regularly under the eye of the coach, who can walk up and down the edge and rate his men comfortably without having to keep one eye on the towpath along which his old horse is trotting. It is probable that training in a tank like this would tend to deprive the stroke of its elasticity and spring, but, even if this be so, the drawback would be quite compensated for by the freshness and the liveliness of the boat which the men would feel in rowing on a running stream, when once they had got rid of the idea that their craft was slipping away from underneath them. In England the weather is never severe enough to make the employment of such an invention as this necessary, though there are days when the water freezes on the blade of the oar, and the keen wind comes whistling across the lowlying meadows and driving the flakes of snow like frozen pellets through the zephyr jersey, in which a man might almost be pardoned for looking with envy on the American oarsmen in their comfortable roofed-in tank. Training for the Inter-University boat race is not, as Albert Smith remarked, a bed *ros: fol:* but all its hardships are cheerfully endured for the honor of even being ninth man to the chosen eight, not to speak of rowing in the boat itself.—*The Graphic, London.*

ESSAY ON BREAD MAKING.

THE following essay by Mr. W. T. Callard was read at the annual examination in bread making held by the National Association of British Master Bakers and Confectioners, and is reported by the *British Baker and Confectioner:*

THE BEST METHOD OF FLOUR BLENDING FOR SPONGING AND DOUGHING PURPOSES.

The difficulty of flour blending to the baker lies in the fact that the flours he buys are already blends of two or more varieties of wheat, which seems to be a necessity of modern milling, where the softer, damper sorts cannot be milled separately. It is possible for the large buyers to buy certain distinct lines of flour made from certain characteristic wheats, but for a small buyer it is not always feasible.

The first or rather all-important fact to be considered when making a blend is price. This must be dependent to a large extent on the yield of various brands, and should be adjusted over the whole blend, including both sponge and dough; for, according to the state of the market, it is often advisable to use flours which are high in price per sack to supply the deficiency of those which may be bought at lower prices, but lacking in one particular.

Varying harvests considerably affect not only the relative prices of flours, but also their respective color, flavor, and strength. It is, therefore, necessary to take a standard of these three qualities of the loaf required, and select flours accordingly.

Supposing ten points were given for the loaf, they would be apportioned as follows: Three points for size, three points for color, and four points for flavor.

Each flour should be tested separately, and marks given for it under these three different headings, and if any one attribute be deficient, a flour which possesses the missing attribute in excess should be used to supply the deficiency, always bearing in mind yield and price. The desideratum is to always have the blend of flours of equal color, flavor, and strength, and by apportioning a certain value to every flour under each of the three headings, the values may be arranged respectively, according to the class of bread required. To do this it is absolutely necessary to test each brand separately, the baking test to be preferred, and to award the relative points according to the result of test.

The flours in the example would be chosen in this ratio:

	Strength.	Color.	Flavor.	
Sponge flours .	5 points	2 points	3 points	= 10 points.
Dough " ..	2 "	3 "	5 "	= 10 "

For sponging, I should prefer a Minnesota Patent; failing that, an English Milled Patent, and for doughing a mixture of flours or flour from these following typical wheats: Five parts for color and flavor, good English (Somerset) wheats; two parts for strength, Northern Duluths; one part California, for richness of color or bloom; and the other two parts selected according to the market values, probably one Ghirka and one Oregon or Kansas, or perhaps two Ghirkas entirely, according to the market value.

As typical flours for the two stages, let me mention for—

Sponging.—Minnesota Patents (such as Pillsbury's Best), some best Russians, Duluths, and most spring wheat patents. Either one would be good by itself, or a blend of any two in the last three, in equal proportions.

Doughing.—Oregons, Californians, Winter Wheat Patents, English, Kansas, and other softer varieties; if any Indian be used, it should be added at this stage.

A very small proportion of doughing flours may be used in sponge stage to shorten the time of fermentation, or to start the yeast if it should be required, but it is not a practice to be recommended.

A larger proportion of sponge flours may be used in the dough stage, according to price and type of loaf required; but if a large proportion of very strong flours be used at this stage, more yeast must be used per sack, or the peptonization of the gluten will not be complete, and the risk will be run of indigestible bread, as well as the crust being "red" or "foxy." This is a case in which malt extract may be used with advantage.

If straight grade (whole flour from wheat) milling should ever become general, this process of blending will be much simplified, but under present conditions of trade such a desirable object is not likely to be realized. Then the same system would apply, but the difficulty of blending flours which have already been blended to suit the merchant would cease, as flours from certain wheats are far more likely to maintain their characteristics than millers' mixtures. Even then judgment as to the relative value of different harvests must be considered.

After the blend has been carefully selected, let it be thoroughly mixed in a large bin, with maltsters' shovels, by hand, or any mechanical contrivance, but any machine which by its action unduly presses the flour together should be avoided. When this operation is completed it should be carefully sifted and weighed into convenient quantities, and stored in sacks or bins, and allowed to remain for some days—not less than three, but preferably a week—in order that the dry and moist flours may assimilate the moisture, and the flavor permeate the whole, or, in other words, to allow the flour to "mellow." Immediately before using, the flour should be sifted again to insure perfect mixture in the dough machine.

In establishments provided with an automatic weigher over the kneader, which weighs flour as required, the weighing into sacks may be dispensed with, but with flour weighed and water measured in a specially gauged cistern, placed conveniently near the kneader, we possess a great safeguard against doughs of variable size, and consequently pile, texture, and volume of loaf.

THE BEST METHOD OF FERMENTATION FOR BREAD.

The following five systems are all capable of producing good bread, and it must be left to circumstances and choice to determine which is the best. 1. Sponge and dough. 2. Ferment, sponge, and dough. 3. Ferment and dough. 4. Dough made to lie four hours. 5. Dough made to lie twelve hours. Each system has its advantages and disadvantages; they need slightly different flours, and also some of them give much better results with certain yeasts than others, and it must be according to the requirements that the selection is made.

I prefer under ordinary conditions that of sponge and dough; first, because of its simplicity; second, because of the ease with which it can be conducted; third, because of the opportunities it affords of using dry, strong flour, most favorably, as well as those weaker and of better flavor, with a doubly good result, and also on account of the comparatively small cost for yeast compared with some other systems, as the yeasts will reproduce in a slack sponge. It is also most convenient for working hours. As I have detailed this method in a former part of this paper, I will make no further reference to it beyond that the quantities of yeast and salt are eight to nine ounces of yeast to the sack, and salt three pounds per sack, eight ounces of which is added to the sponge. No. 2 method is practically the same as the above, only better adapted to a lower or weaker kind of yeast most suitable for those employing malt and hop, patent, composition or brewers' barms. With any of the composition variety the ferment should be allowed five or six hours. These yeasts are found to be slow and unreliable, partly on account of the atmospheric conditions surrounding its manufacture. It is impossible to expect, in an ordinary bakery, that such a delicate operation as yeast making can be safely carried out, owing to the elaborate appliances needed to cool the mashes rapidly, and to protect the worts from obnoxious germs.

These uncertainties render it only suitable to be used where fresh and regular supplies of compressed yeast cannot be depended on.

3. *Ferment and Dough.*—This method is suited to conditions where space is a very considerable object, as with very few tubs and a couple of troughs a very fair-sized trade may be done, and one man may control all the ferments, etc., even for a large trade. It is contended that the fermentation being completed in a short time—three and a half to four hours—there is much less chance of souring, but that this is a fallacy may be noted by the large quantity of sour bread produced by these methods. It frequently happens that there is a delay of some minutes in taking a ripe ferment, which matures in from twenty-five to fifty minutes, and then when the yeast has used up all its food (glucose) is a favorable opportunity for souring. Certainly much of the bread made by this process is of bad shape and color, especially in the crust. The cost of yeast (from three pounds per sack) must be considered, as also the fact that the doughs lie three hours, during which time they require three "turns." Salt two and one-half pounds per sack.

4. All night doughs are convenient in that there is no delay in taking them when work is begun in the early morning, but I have been unable to satisfy myself with the flavor produced by this method, not being fresh nor the texture fine, while the crust is discolored; in fact, the bread suggests imperfect peptonization. Yeast two and one-half pounds per sack, three pounds salt per sack.

5. Four or four and a half hours is the time occupied in working through fast doughs suitable for fancy breads, which are eaten early and not kept any length of time. It may be adapted to loaf bread, but is only successful when very slack doughs are used (say eighteen gallons or even more per sack), and the doughs require four or five turns. The softness of the dough precludes its being used for high crusty cottages, but is eminently suited for long rolls. The great objection

to this method is the great cost of yeast, being six pounds per sack; also so much skill is needed in determining the ripeness of the dough that it is liable to be placed in the oven before it is ripe, or allowed to ferment too long and spoil. Salt four pounds per sack. The cost of yeast practically places it out of the market for loaf bread.

I have not treated of the Scotch methods of bread making, because, as a rule, they are not appreciated, except when very strong flours are used. The Parisian barms are made of scalded flour mixed with an infusion of malt, and yeast added when cold, and allowed to ferment for three or four days, when the sponges (very slack) are allowed to lie for fourteen to sixteen hours and the dough one and a quarter hours. Salt six pounds per sack. This usually baked in closely packed loaves, and produces a fine pile. The usual objection to the bread made by this system is its acidity or even sourness. Two pounds of the salt is added in the sponge.

Aerated bread is simply flour and water made into dough, and mechanically charged under pressure with carbonic acid gas. This is not to be recommended, on account of the indigestible nature of the bread produced, and the uncooked flavor it possesses, owing to the lack of peptonizing agents. After long and repeated trials, this kind of bread seems rapidly going out of production as a commercial article.

PUT YOUR HEAD TO THE ENGINE.

"How will you have your feet?" the porter asked in a Wagner car coming from Buffalo.

"Feet to the engine," said the passenger.

"If you travel much you'll have your head put next to the engine," said the colored man.

"No," said the passenger, "I am afraid there might be a collision, and then I'd be thrown with all my weight against my head." The porter chuckled.

"I beg pardon, boss," said he, "but I notice dat all de railroad men has their heads put toward de engine—and all the commercial travelers also. The biggest arguments is in favor of doing that way. In the first place, there ain't many head-on collisions. There's more danger of a rear-end collision. The reason is that every passenger train has its own right of way, and runs regularly every night, and is looked out for by all the trains that's running ahead of it. Therefore the most danger is from something behind which don't know when we have stopped or broke something, and which runs into us unexpectedly. There ain't any one looking out for any kind of collisions, 'cause when they come it matters mighty little which end you're putting forward—your head or your feet—but if you insist on looking out for 'em from behind—I'm a-telling you."

"Any more arguments?"

"Got plenty more arguments, boss. You don't want to sleep with your feet toward the engine, because if you do the draught through the car blows right agin your head, and when it gets cold at night your head and chest are exposed. Put your head toward the engine and you feel cool without gitting in no draught. It's just the same way in summer. If you sleep with your feet toward the engine you can't have your windows open, with the screen in 'em, without getting the wind and fine dust right in your face, whereas if you sleep with your head to the engine you get the cool air and no draught and dust."

"Is that all you know?"

"No, boss; I hain't told you the biggest argument yet why you should have your head made up towaru the locomotive. The most serious thing of all is the circulation of the blood in your body. You been having your feet made up toward the engine, eh? Well, I reckon you don't never sleep very well in the cars, do you? Your night's res' is usually broken, ain't it? Well, sir, lemme make up your head to the engine an' you'll sleep like you was a baby. Dat's because the motion of the train is so strong and steady that it sends all your blood toward the end that's furthest from the engine. Put your feet to the engine, and all your blood rushes straight to your head and gives you a restless night. Put your head to the engine and the blood goes away from your head, leaving it cool and easy so as you can res' like a child."

"Put my head toward the engine and stop talking, will you?"

"Yes, sir; all right, sir; anything you say, sir. You wont gredge me dat quarter in the morning, I'm a-tellin' you."

[A lapse of half an hour. Then a voice from between curtains. It addresses the porter.]

"Solomon; Diogenes, porter! Any arguments as to what part of a train is the safest?"

"There aren't no use of arguments 'bout dat, sir. The safest place on a train is the middle of the middle car on the side furthest from the other track."

"Good night, Cicero."

THE TRAVELING BOTTLE AND GLASS.

UPON a table, at the rising of the curtain, are observed a bottle and a glass, the latter full of wine up to the brim. The prestidigitator pours into the bottle half of the liquid, "which otherwise," he remarks, "might slop over during the voyage." Then two cylinders of the same diameter as the bottle are made before the eyes of the spectators out of two sheets of paper and four pins.

These are designed to cover the bottle and the glass, which have been separated from each other by a short interval. (Fig. 1.) Instantaneously, and in an invisible manner, the two objects change place twice, and yet there is never anything in the paper cylinders, which are, ostensibly, torn into a hundred bits.

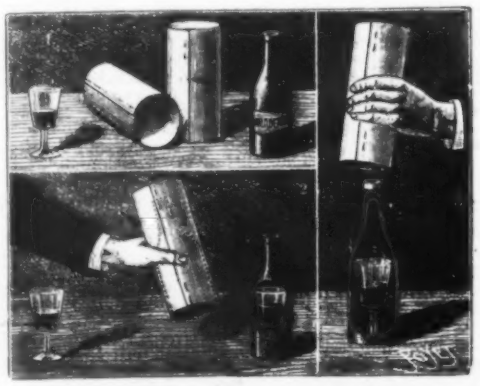
Fig. 3 unravels the mystery. The bottle is of varnished tin, and bottomless. It covers a second bottle that is similar, but a little smaller, and in the center there is concealed a glass similar to the one that has been shown, but empty. It receives the half of the wine that was poured from the first glass. This operation necessarily contributes toward convincing the spectators that they have before them an ordinary bottle provided with a bottom and capable of containing a liquid.

The operator first covers the bottle with one of the paper cylinders as if to ascertain whether it has the proper diameter, but immediately removes it and places it upright upon the table.

What no one can suspect, however, he has at the same time lifted the first bottle by slightly compressing the paper. It is then the second bottle that is seen, and which is precisely like the other, the labels of both being turned toward the same side and exhibiting a slight tear or a few identical spots designed to aid in the deception.

The operator, having finished his palaver, places the empty cylinder upon the second bottle and covers the glass with the one in which the first bottle is concealed. (Fig. 2.) The magic wand is then brought into play, and after this the paper cylinder alone is lifted at the side where the glass was in the first place seen, while at the opposite side, the bottle, on being removed, exposes the glass that it concealed. The operation is begun over again in the opposite direction; and, finally, under pretense of once again showing that either paper cylinder can be used indifferently, the operator replaces upon the second bottle the cylinder that still contains the first one, unbeknown to the spectators.

This is done so rapidly that the action is apparently



TRICK WITH A BOTTLE AND GLASS OF WINE.

but a gesture, but nothing more is needed to free the cylinder of its contents and re-establish things in their former state.—*La Nature.*

[FROM THE KEW BULLETIN.]

POLING IN AGAVE PLANTS.

THE progress of the fiber industry in the Bahamas has been fully noticed during the last four years in the pages of the *Kew Bulletin*. At the present time the earlier plantations are approaching maturity, and it is anticipated by those interested in the subject that the export of fiber on a commercial scale will probably begin next year.

In the meantime a question of some importance has arisen in regard to the duration of life of the particular sort of *Agave* cultivated for fiber purposes in the Bahamas.

This is botanically known as *Agave rigida*, var. *sisalana*. It is a dark green, smooth-leaved sort (with no marginal teeth), originally introduced, either directly or indirectly, from Yucatan. There it is known under the aboriginal name of Yaxci.

The plant more generally cultivated for fiber in Yucatan is a glaucous-leaved sort, armed with small, black, marginal teeth (*Agave rigida*, var. *elongata*), known locally as Sacqui. The Bahamas plant, Yaxci, is still also found in Yucatan, but apparently it is not specially selected for general cultivation.

Of *Agave* plants, a familiar example, grown in greenhouses in this country, and sometimes put out for decorative purposes during the summer months on lawns and terraces, is that commonly called the American aloe (*Agave Americana*). Such plants produce nothing but leaves for the greater part of their life. In this state they may last for many years. In some species there are also occasionally produced root suckers, which afford a ready means of increasing the plant. This, however, is a purely vegetative reproduction. The exact life period of agaves in northern latitudes may vary from 10 to possibly 50 years or more. On account of this exceptional longevity among succulent plants they are sometimes called century plants. In the tropics, grown under natural conditions, these plants seldom last longer than 7 to 12 or 15 years. Sooner or later, however, within the periods above mentioned, and depending on conditions under which they are placed, they throw up a "pole" or flowering stem. On this will successively appear the flowers, the capsules bearing seed, and possibly also numerous bulbils. In some species there are produced abundant seeds, but no bulbils; in others there are produced bulbils only, and no seed. The ripening of the seed or production of bulbils, whichever may be the normal habit, brings the life of the plant to a close. After this the whole plant withers and dies.

The question raised in the Bahamas, and respecting which the aid of Kew has been sought, has reference to the exact length of time the Yaxci (*Agave rigida*, var. *sisalana*) may be expected to last in the leaf state. In other words, how long can the plant be made available to the planter for the production of fiber? The matter is naturally one of great interest to the Bahamas people, for on it hangs the success of their plantations. The result of the inquiry at Kew is given in the following correspondence. It is so far satisfactory that, with care and judgment on the part of those directly in charge of the plantations, there need be no greater cause of anxiety in the Bahamas than has been felt during the last thirty years in Yucatan, for plants that have poled might easily be replaced from time to time by strong, healthy "supplies" from nurseries, and the work of the plantations need not at any time be seriously interrupted.

MR. NEVILLE CHAMBERLAIN TO ROYAL GARDENS, KEW.

Memorandum.

July 26, 1893.

Information has been received from the Bahamas of a somewhat serious nature in reference to the Sisal industry. It will be remembered that in the wild state these plants pole when about seven years old, but it was supposed that the cutting of their leaves when cultivated would delay the poling and prolong the life of the plant, as is said to be the case with the Yucatan variety. It is said, however, from observation of old plants in the Bahamas, that cutting makes no difference to the life of the plants, which seldom exceeds seven years. As four years at least are needed for the growth of the plants before they are fit for cutting, this only leaves between two and three years of cropping, in which the planter must recover all the capital expended in their cultivation. Any suggestions by which the life of the plants might be prolonged and poling prevented are invited, as the early poling will gravely affect the success of the industry. N. C.

THE MONROE FIBER CO., LIMITED, TO ROYAL GARDENS, KEW.

Abaco, Bahamas, July 20, 1893.

Dear Sir: The interest shown by your department in the fiber industry of this colony, and the valuable information you have afforded in connection with the plant, have prompted me to submit the following questions, which deal with points of prime importance to those engaged in its cultivation. In fact, I do not know to whom else to apply, for our plant is undoubtedly different from that commonly grown in Yucatan, and no one in the Bahamas seems able to speak with certainty upon the subject under review.

Our plant, or "Bahamas hemp," as it is now termed, is an Agave with dark green leaves, which are spineless except for a thorn at the tip. From all accounts, it is identical with the "Yaxci," of Mexico.

1. The life of the "Sacqui," which is that generally grown in Yucatan, is said to be from eight to sixteen years after cutting has been begun. Can you tell me whether our variety enjoys as long a life or not?

2. Do Agaves put out during their life a certain fixed number of leaves, the normal quantity varying but little between plants of the same species, or is there no regular limitation in this respect?

3. If the output of leaves on a plant is variable, would cutting them as they mature be likely to increase it, and, judging from analogy or otherwise, ought the cutting to be made several times a year or at any particular seasons? Also, would cutting the leaves have the effect of prolonging the life of the plant by retarding its poling?

It may seem strange to ask for such information when we have the plant here growing under our eyes, but it is only now reaching the cutting stage on most of the plantations, and where it has been longer established there unfortunately does not seem to have been much observation bestowed upon its nature or the circumstances of its growth.

You can easily perceive the necessity we are under of obtaining a clear understanding on the points raised in this letter, as, for instance, when it will be advisable to reset the fields with young plants so as to be ready to take the place of the old ones as the latter die off, and also how to prolong the life and increase the yield as much as possible. I need not say how thankfully any assistance you may kindly give in this direction will be received.

Yours, very obediently,
(Signed) J. GURDON.

The Director, Royal Gardens, Kew.

ROYAL GARDENS, KEW, TO MR. AUSTEN CHAMBERLAIN, M.P.

Royal Gardens, Kew, August 18, 1893.

Dear Mr. Chamberlain: When your brother was last at Kew he left with me a memorandum respecting the age at which plants of the Yaxci, of Yucatan, now known as the "Bahamas Pita" or Sisal, reach their maturity. He also asked whether anything could be done by processes of cultivation to retard the poling or the appearance of the flowering panicle, which it is well known marks the duration of the life of the plant.

2. There is apparently very little reliable information obtainable in regard to the age at which these plants flower. In fact, in the whole of the literature of the subject the references are very few and the language is vague and inconclusive. In the inclosed memorandum I have given a brief summary of what has been recently published, and it may be possible to draw some general conclusions from the facts therein stated.

3. The observations in regard to the Sacqui of Yucatan do not, it is true, bear directly upon the subject. But as the Yaxci or Bahamas Pita is only a variety of the same species, it is improbable it should differ in any marked degree from that plant. The length of time that elapses previous to flowering in Agave plants may in some degree be affected by soil and climate, but as a general process of growth and with plants cultivated normally over a large area, the experience in Yucatan may not be far from what will ultimately obtain in the Bahamas.

4. The latest information from Yucatan is furnished by Mr. Pierce, the vice consul at Merida. He states that "a hemp plantation in Yucatan lasts for some fifteen years." This is not conclusive as regards the age of the individual plants. It merely shows that while some of the original plants may pole at one age and some at another, their places are so filled up from time to time by new plants that the whole undertaking receives no serious check up to about the fifteenth year.

5. It appears to be recognized in Yucatan as the result of experience (without apparently any reference to the determining causes) that poling is encouraged among these plants if the leaves are left uncut for any length of time after they have arrived at maturity. There is little or no scientific basis for this opinion, and experience at the Bahamas should be carefully recorded if tending in that direction.

6. They also believe in Yucatan that if the root suckers, which are abundantly thrown out round the base, are allowed to remain attached for a long period, they tend to exhaust the parent plant and accelerate the period of poling. Such suckers no doubt divert the strength of the parent plant, and if allowed to remain too long either of two things must happen—the parent plant will produce fewer and smaller leaves or its period of maturity will be hastened. The practical outcome of this is the suggestion that such suckers

as are necessary for supplying the plantation should be removed when large enough into nurseries and all others, not required, should be removed periodically and thrown away.

7. Mr. Stoddart, it is noticed, records that the Yucatan people are very particular when cutting the leaves to cut them as close as possible to the stem of the plant. In other words, they consider it undesirable to leave any portion of the base of the leaf to form what is called in tree-pruning a "snag" on the parent plant. A certain degree of "snag" is inevitable. This, however, afterward falls off, when dry, leaving the central stem of the plant eventually quite clean. I am not prepared to attach much importance to this matter in relation to poling. It is undesirable as a matter of economy in fiber, and it may also have some effect on the general health of the plant. It certainly would produce an untidy appearance in the up-keep of the plantation, and altogether the practice of close cutting the leaves should be systematically carried out.

8. Coming now to the Sisal plant as known in Florida and the Bahamas, it is evident that an impression prevails both in Florida and the Bahamas that some of these plants have flowered at about the seventh year after planting. The instances recorded are given in the accompanying memorandum. They are, however, not conclusive. The exact history of the suckers before they were put out, and the treatment they afterward received in regard to cutting the leaves and allowing the suckers to remain on indefinitely, are not given. All these are important factors to be considered before an opinion can be formed. The result of further and wider experience will probably show that some plants may pole at seven years, others at a later period. It is unlikely, if properly treated, that they will all pole over a large plantation at the same time. If the plantation is carefully watched and fresh plants are put in immediately the fact is realized, or at the first sign of poling, there need be little interference with the work of the plantation.

9. It is essential that fresh plants in large numbers be grown on in nurseries with the view of supplying any vacancies caused by poling. Also the pole should be cut out as soon as it appears above the leaves, in order that the leaves already formed should be ripened before the plant dies. This practically means that the plant would be kept available for yielding fiber for nearly a year later than it otherwise would be.

10. There is another point to be briefly noticed. While it is important that all the mature leaves be cut when they have attained full development, great care should be taken that the immature leaves are not also cut. The regular cutting of the fully matured leaves might possibly tend, as mentioned above, to prolong the vegetative life of the plant and retard poling. Theoretically, however, there is no ground for such a supposition. On the other hand, the cutting of immature leaves would certainly have a contrary effect. The plant would be likely to be weakened by the process, and the subsequent leaves borne by it would be smaller and weaker. The exact period when the leaves are to be cut should be carefully studied. As a general rule the leaves are ripening when they are gradually falling from the erect into the horizontal position on the plant. Also there may be some indication in the color of the leaves. These are, however, matters to be decided on the spot by careful and skillful people. It is only necessary here to draw attention to them, and to state that both the life of the plants and the quality of the fiber, in other words, the success of the whole undertaking, may not improbably depend upon them.

I am, etc.,
(Signed) D. MORRIS.

J. Austen Chamberlain, Esq., M.P.,
40 Prince's Gardens, S. W.

Memorandum.

THE LIFE OF SISAL HEMP PLANTS.

There are numerous species of Agave (popularly called aloes) belonging to the natural order *Amaryllideæ*. They are almost all monocarpic perennials; that is, they grow on for a number of years producing leaves only; finally they flower, and this they do but once in their life, and that period is apparently determined by the nature of their environment. Usually Agaves under cultivation in this country live to a great age. On this account they are sometimes called century plants. In their native country they live for seven to fifteen years. When once the monocarpic species have flowered and produced seeds or bulbils (pole plants) they die. The following notes refer to the Sacqui (*Agave rigida*, var. *elongata*) and to the Yaxci or Bahamas Pita (*Agave rigida*, var. *sisalana*):

(*a.*) Mr. Stoddart says, "The plant (the Sacqui of Yucatan) lasts . . . for at least twenty-five years in a cutting state, depending on the soil and treatment." To renew a plantation after the original plants have become exhausted, "it is usual to plant at proper distances, by the sides of the old plants or between them, young shoots which three years afterward (and upon the failure of the old ones) will be fit for cutting." A new field will thus "be kept up without any loss of time or suspension of work." (Sisal Hemp, its Adaptation to Jamaica, p. 4.)

(*b.*) Mr. Stoddart describes the poling as follows: "This happens when the plant has arrived at cutting age *and the plants are not cut.*" . . . "When the pole begins to come out and gains a length of about three or four feet, it is customary to cut it off close without injuring the leaves. These leaves will then mature and be fit to be taken off before the plant dies." (l.c. p. 7.)

(*c.*) Poling appears to be accelerated (1) by the leaves not being cut when they have arrived at maturity, (2) by the plants being exhausted by numerous suckers allowed to remain around their base, (3) by careless cutting of the leaves. Stoddart on this latter point says: "If the stump (or base) of the leaf be left of any length on the trunk it seriously injures the plant, spoils its vigor, and *makes its existence a short one.*" (l.c. p. 7.)

(*d.*) Mr. Pierce says: "A hemp plantation in Yucatan lasts for some fifteen years. . . . On good land the crop commences in four years or earlier, while on rocky ground from six years or more." (F. O. Report, 1892, p. 2.)

(*e.*) Mr. Dodge, discussing the Pita or Yaxci plant of Florida and Bahamas, remarks that in one instance, on very poor soil, he noticed that "a long row of plants set out ten years ago to form a boundary line had hardly made any growth." (Report of C. R. Dodge on "Fiber Investigation in the United States." Washington, 1893, p. 21.)

Mr. C. T. McCarty, of Ankona, Florida, says: "With us *Agave sisalana* sends up its pole at seven years on our best lands. . . . So far as the plant is concerned, the 'poor land' theory has no foundation in this locality. Our strongest and finest plants are on our best land." (Dodge, l.c. p. 15.)

(*f.*) Mr. Merrick Shaw, Polk County, Florida, describes a Sisal hemp plant under his observation as follows: "The original plant growing on the soil, of which a sample was sent, poled at seven years old. Twenty layers of leaves had been cut from this plant, and the lowest of those remaining measured 5 ft. 9 in. in length by 5 in. in width at the broadest part. About 100 suckers had been removed from (the base of) this plant and planted elsewhere." (Dodge, l.c. p. 17.)

(*g.*) Mr. Dodge figures and describes a plant with leaves barely a foot long, which had thrown up a slender pole to a height of eight feet or more. He adds: "I was informed by residents on Indian Key that this premature blossoming of a young plant or sucker *while yet attached to the parent root* is not of uncommon occurrence." (Dodge, l.c. p. 18.)

Kew, August 16, 1893. D. M.

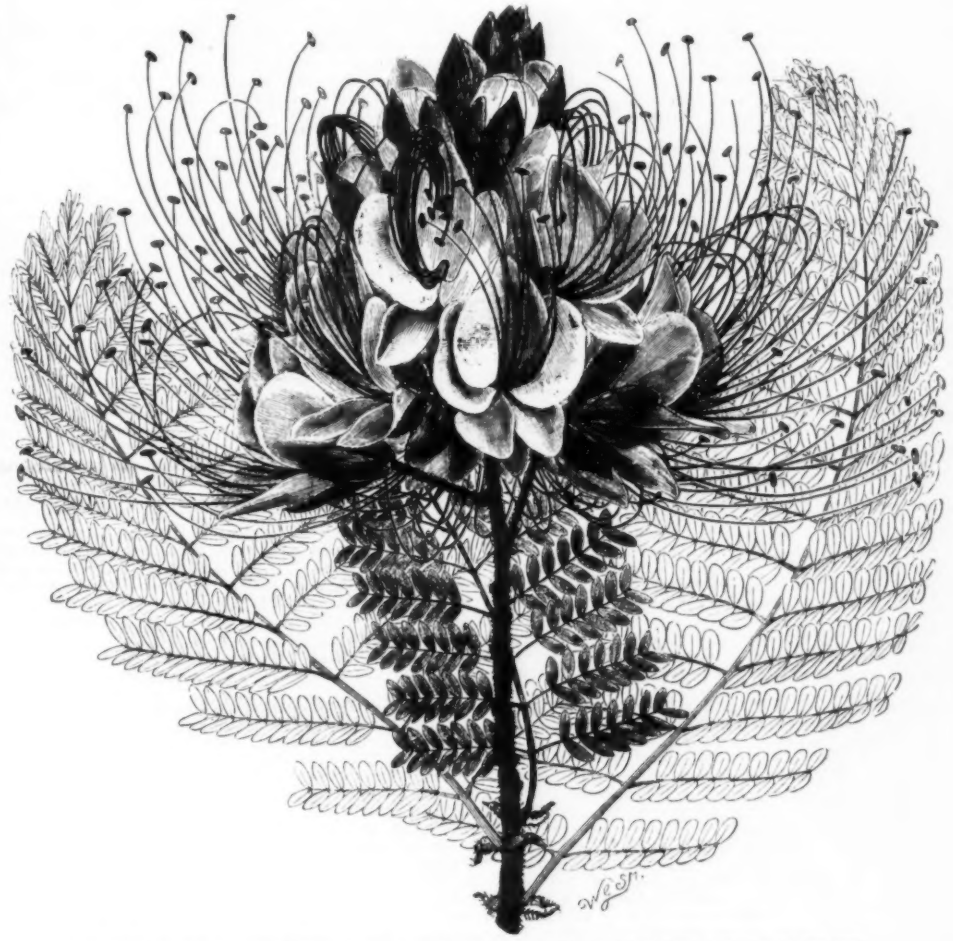
[*Note added.*—The plant cultivated in Mauritius, and yielding what is known as Mauritius hemp, is the green or fœtid aloe (*Furcræa gigantea*). The value of the exports are about £50,000 annually. This plant is similar to an *Agave*, both in appearance and habit, and it also produces numerous bulbils or pole plants after flowering. The experience in Mauritius with regard to poling of the *Furcræa* has a striking resemblance to what has been observed in regard to the Agave in Yucatan. M. de Chazal, who has written an account of "*Le fibre d'Aloes*" (Mauritius, 1882), states (p. 21) that "the plants generally pole at the age of seven or eight years; they can, therefore, be cut four or five times before poling and before it is necessary to replace them." On the same subject Mr. John Horne, F.L.S., late Director of Gardens and Forests in Mauritius, writes under date of September 4, 1893, as follows: "The life of *Furcræa gigantea* in Mauritius is from seven to ten years; . . . as many of the plants flower three to four years earlier than others, the leaves of the seedlings (or pole plants) from these are fit for cutting when the late flowering plants are dying out, so cutting once begun on a plantation may be said to be continuous. . . . Supplying among old plants should be done in time so that as the old ones die out cutting from the young ones should begin. Over-cutting the leaves is common in Mauritius. This is generally held to be injurious to the plants, weakening their growth and causing them to flower and die prematurely. People in Mauritius say that by cutting only the mature leaves the growth of the plants is not weakened, and thus large fine leaves are obtained, yielding long fiber of the finest quality. But I have never heard the idea expressed that such a manner of cutting prolonged the life of the plant beyond what I might call the natural limits. It is said in Mauritius that over-cutting weakens the plants and causes them to flower and die prematurely, so it may be also said in Yucatan that cutting only the mature leaves prolongs the life of the plants to its natural limits. It comes to this, that what is said not to shorten the life of the plants in Mauritius is said to lengthen it in Yucatan—a case of arriving at the same place from opposite directions."]

POINCIANA GILLIESII.

As an out-of-doors shrub in the mildest parts of Britain, there is nothing which approaches Poinciana Gilliesii for the beauty of its yellow and scarlet flowers. We are indebted to the kindness of the Rev. H. Ewbank, St. John's, Ryde, Isle of Wight, for the flowering shoots from which our engraving was prepared, and who had a strong growing example in full blossom at the end of the month of September, and in October last year.

About London the plant succeeds against a warm wall, flowering in July, and later, according to the season, some slight protection being afforded it during the winter. It is a native of the province of Mendoza, in Chile, where it is found in sheltered situations, between the rivers Diamante and Atuel, and also along the western side of the Rio Quarto. The flowers have a sickly smell, and are supposed by the common people to be injurious to the sight. Hence its vernacular name Mal d'Ojos.

Leaves bipinnate, leaflets oblong, about twelve rows on a side; rachis, and bracts, covered with a coarse brown glandular coating; sepals fringed with hairs and glands, petals erect, stamens very long, red.—*The Gardeners' Chronicle.*



POINCIANA GILLIESII—HALF HARDY SHRUB, YELLOW AND SCARLET.

THE GIANT REFRACTING TELESCOPES OF AMERICA.

By A. C. RANYARD.

WE live in an age when "records" are almost daily being broken, but it is now almost half a century since the largest telescope yet turned to the heavens was completed by the father of the present Earl of Rosse. He cast his gigantic mirror, six feet in diameter, on the 13th of April, 1842, and after nearly three years' labor it was mounted at Parsonstown in February, 1845. This great telescope, contained in a tube seven feet in diameter, with a focal length of fifty-four feet, still remains the greatest light-grasping instrument which has been turned to the stars; but its defining powers are very inferior to many smaller instruments which have since been made.

It was not till 1846, a year after the completion of the Rosse reflector, that refracting telescopes reached a diameter of fifteen inches. In that year, Merz and Mahler, of Munich, completed two fifteen-inch refractors, one for Harvard College Observatory and the other for Pulkowa. These comparatively small telescopes quickly showed themselves to be superior in defining power to the great Rosse telescope. With the Harvard telescope Prof. W. C. Bond, in 1848, discovered Hyperion, the eighth satellite of Saturn, a discovery which was almost simultaneously made by Mr. Lassell in England, with a reflector of two feet aperture of excellent defining powers. In 1850 Bond also discovered, with the Harvard fifteen-inch refractor, the crape ring of Saturn, a discovery which was likewise very nearly simultaneously made in England by Dawes, with a reflecting telescope of smaller aperture.

For about fifteen years the limit of aperture for refracting telescopes attained by Merz was not exceeded; then America took the lead, and in 1860 Alvan Clark, the father of the present instrument maker, made an eighteen and a half inch refractor, with which he discovered the companion to Sirius. For ten years this

remained the largest refractor in existence; then England took the lead with a twenty-five inch object glass made by Cooke, of York, for Mr. R. S. Newhall, of Gateshead, in 1870. Three years later, Messrs. Alvan Clark & Son made the twenty-six inch refractor for the Washington Observatory, with which the satellites of Mars were discovered. Then followed two thirty-inch refractors, one made by the Brothers Henry, of Paris, for the Nice Observatory, and the other by Messrs. Alvan Clark & Son for the Russian Imperial Observatory at Pulkowa; and, lastly, the thirty-six inch refractor made by Alvan Clark & Son for the Lick Observatory. The optical excellence of the great Lick telescope is vouched for by the work done with it by Mr. Burnham on close double stars, and by the discovery made with it by Mr. Barnard of the fifth satellite of Jupiter.

American astronomers have always shown a preference for refracting telescopes; with the exception of the late Dr. Henry Draper, who figured and mounted for himself a twenty-eight inch silver on glass reflector, no American has constructed a reflecting telescope of any considerable size. Their scientific enthusiasm has restrained them from merely endeavoring to outdo the Earl of Rosse in the construction of instruments of great light-grasping power, and has turned their inventive genius to the difficult problems involved in the evolution and growth of the achromatic telescope. The French still retain the lead as the makers of large disks of optical glasses from which the large refractors are made. The disks of flint glass from which the flint lens of the object glass of the Lick telescope was made took three years to manufacture. It was repeatedly tested and the defective parts were cut out and replaced by fresh optical glass which was welded to the original mass by pressure at a white heat; the disk was then slowly allowed to cool, and again tested, and any new defects found were again operated upon.

The difficulty of manufacturing large homogeneous disks of optical glass is, at present, the chief obstacle in the way of increasing the size of achromatic telescopes. Such large masses of glass are very heavy, and when supported by their edges in a cell their weight causes the lenses to bend; but a small amount of flexure causes less disturbance in the image thrown by a lens than a similar amount of bending of a speculum would cause in the image thrown by a speculum.

For if a reflecting surface is shifted through a small angle the reflected ray is shifted through double the angle, while a similar change in the position of a refracting surface causes only a very slight shift in the direction of the refracted ray. Thus it happens that though lenses can only be supported by their edges, while specula can be supported at their backs as well as at their edges, the small distortions due to the weight of material cause a greater disturbance in the image thrown by a large reflector than in the image thrown by a large refractor; otherwise large reflectors would be vastly superior instruments to large refractors, for with reflectors light of all colors is brought to the same focus, while the difficulty of achromatizing a lens increases with its diameter, and the larger a refractor, the greater must be the ratio of focal length to aperture in order to obtain the same degree of achromatism. Thus the focal length of the Lick telescope is fifty-seven feet ten inches, to an aperture of thirty-six inches, and the Yerkes telescope will have an aperture of forty inches and a focal length of nearly sixty-four feet, or a ratio rather less than one to nineteen, instead of one to twelve, as with small achromatics.

With every increase in focal length all the mechanical difficulties connected with the mounting and the size of dome and shutter increase as the cube of the focal length, for the weight of all the parts increases as the cube of their lineal dimensions. Consequently, every effort is made to keep down the focal length of such large telescopes, so far as it reasonably can be kept down consistently with a sufficient degree of achromatization for defining purposes. An observer who looks through one of these large refracting telescopes for the first time is greatly struck with the amount of outstanding color around the stars. The violet end of the spectrum is generally left outstanding, and the star appears bathed in a field of violet light, which, however, interferes very little with the sharpness of vision.

The great telescope which Mr. Charles T. Yerkes is presenting to the University of Chicago is dwarfed by the size of the Exhibition building, but if the size of the figures standing in the neighborhood is compared with the telescope, it will be seen that it is much larger than the Lick telescope, which at first sight looks larger.

The lenses for the Yerkes telescope are already roughly figured, but they are not finished. Mr. Alvan Clark was present at the last meeting of the Astronomical Society, and gave the fellows an account of the way in which the work is proceeding. I have also received some additional information from Prof. Hale, who is at present in Berlin.

The flint lens is very white. It is a particularly fine piece of glass and weighs about three hundred pounds. Its thickness is about one and a half inches at the center and two and three-quarter inches near the circumference.

The crown lens weighs about two hundred pounds. It is about three inches thick at the center and seven-eighths of an inch at the circumference.

The flint lens corrects the crown, so that the minimum focus will be at about wave length 561.

For photographic work with the spectroscope in the blue, violet and ultra-violet, a small lens will be used near the focus for correcting the chromatic aberration at the center of the field only. Dr. Huggins has used such a lens with his visual objective, and succeeds in bringing the spectrum from F to H satisfactorily to focus. The spectroscope thus remains in its ordinary position, while in the Lick telescope, when the photographic correcting lens is placed over the objective, the focus is changed from fifty-seven feet ten inches to forty-seven feet ten inches, and in practice the spectroscope is not used when the corrector is in place. The principal advantages of the small correcting lens are: (1) small loss of light from absorption; (2) no change in the principal focal plane; (3) convenience in handling; (4) its weight is so small that no change in the balancing of the telescope is necessary on adding the corrector. Its chief disadvantage is that a small lens so near the focus only gives a small field of view, but this is immaterial for stellar spectroscopy.

The telescope, dome and shutter will be moved by electric motors controlled by buttons on a keyboard at the eye end, but the motions can also be directed from the balcony at the head of the telescope, and from a table in the observing room.

Hydraulic rams, which can also be controlled electrically in the same manner, will lift or lower the whole floor of the observatory, so that no observing ladders will be necessary.

The clamps of the telescope are operated by powerful electro-magnets, and it has been found that the instrument can be instantly clamped much more firmly than in a longer period by hand.

The driving clock, which weighs about one and a half tons, is never allowed to run down, but when the weight has descended to a certain point it automatically starts an electro-motor, which winds the clock up again.

All the motions, clamps, etc., can be operated in the ordinary way by hand.

The dome for the Yerkes telescope will be eighty feet in diameter, and the observing shutter will be fifteen feet wide.

The tube for the Yerkes telescope is forty-two inches in diameter at the objective end, fifty-two inches at the center, and thirty-eight inches at the eye end. The sheet steel forming the tube varies from 7-32 inches in thickness at the center to 1-8 inches at the ends. The total weight of the tube is six tons.

The declination axis carrying the tube is of forged steel, twelve inches in diameter, and twelve feet long; its weight being one and a half tons. It runs in segmental bearings in the declination sleeve, which weighs four tons.

The polar axis carrying the whole system is of forged steel, fifteen inches in diameter at the upper bearing and twelve inches at the lower bearing, and weighs three and a half tons.

The great weight of the bearings on these axes is almost wholly relieved and the resistance changed from sliding to rolling friction by means of three bracelets or live rings of steel rolls. One of these encircles the declination axis near the tube, and one is placed above each bearing on the polar axis. These anti-friction live rings are pressed against the axes by means of adjustable springs.

The pier or column is made in five sections. The base section weighs about eighteen tons, the other sections weigh about five and a half tons each. The height of the column, from base to top, is thirty-one feet four inches. Each section of the pier is above six and a half feet high. The head of the pier is of cast iron, in one piece, and weighs five and a half tons. The total weight of the pier and head is about forty-five tons. The height from the base of the pier to the center of motion is forty-three feet six inches, and the total weight of the whole telescope and mounting will be about seventy-five tons.

Mr. Yerkes has purchased about fifty acres of land on the borders of Lake Geneva, Wisconsin, as a site for the new observatory. The plans for the building are now being prepared and its construction will be commenced in the spring. The observatory will be about one hundred and fifty feet above the lake, and at a distance of about seventy five miles from Chicago. Prof. Hale has been appointed director of the observatory, and Mr. Burnham has recently been appointed professor of practical astronomy in the University of Chicago and astronomer in the Yerkes Observatory. No other members of the staff have as yet been appointed. With two such exceptionally able astronomers, one may confidently look forward to many important discoveries being made on the borders of Lake Geneva.—*Knowledge.*

THE CIPHER CODE.

THE Navy Department has a book which, unlike most government publications, is guarded with great care from the scrutiny of all persons except those who hold close official relations to the Secretary of the Navy. The words, printed in parallel columns, are nothing more than a combination of letters, so arranged that no one but an expert who holds the key can make head or tail of their meaning or even pronounce them. A cursory glance at this book would lead most persons to the belief that it was a dictionary of some unknown language. The book is the cipher code used by the department in communicating with naval officers when they are on foreign stations. It is now not only used exclusively in all messages sent by cable to and from the Secretary of the Navy, but is also used by Secretary Gresham instead of the uncertain and unreliable code of the State Department.

The necessity of the code became manifest some eight years ago, when it was found that the system of cipher messages then in use was imperfect, and could be easily deciphered should any person secure a copy of the key book. To meet the requirements a board was ordered by the department to devise a new code, which should be reliable, and at the same time be so complex as practically to prevent outside parties from arriving at the meaning of the characters even with the book before them. The result was the formulation of the code system now adopted. It is believed that without proper instruction no living mortal could ever arrive at the meaning of the words of a message written in the new cipher. Admiral Stanton a few days ago received a message to proceed with the old Kearsarge to Bluefields, Nicaragua, and two days afterward a message came to the department in cipher saying that no one on board could make out a word of the department's order. This was not due to the complicated nature of the message, but to blunders of the telegraph operators, who are responsible for more trouble in deciphering the messages than are those who write them.

The cipher book contains almost as many words as a school dictionary. They are arranged in columns, and some of the words contain ten letters and some three, but none more or less. Most cable companies charge two words for every one containing more than ten letters, and to avoid this the code is so arranged as to have no word contain more than ten letters. When the Secretary of the Navy wishes to send a message, he first writes it in plain English, or dictates it to a typewriter, who writes each word out with great care and distinctness. It is then given to two officers now at the Navy Department, who are known as the cipher experts. The cipher book is always under lock and key when not in use, and the chief of the Navigation Bureau, who has charge of the movements of all ships, instructions to officers, and the receipt and transmission of cable messages, is responsible for its care and safe keeping. When a message is to be put into cipher, however, no great care is shown to keep the book from the public. At almost any time during the past two months a person going into Commodore Ramsay's office could see two young officers seated at a desk with a message in typewriting before them and on either side two books about the size and thickness of a school atlas. It takes time to put a message into cipher, as great care has to be taken to prevent the misplacing of a single word, which would change the meaning of a sentence and make it extremely difficult, if not impossible, for the officer receiving it to translate it. Even more time is required to translate a message, and when there is a mistake it often takes several hours to put into a readable form a message containing not over one hundred words. Some weeks ago a message came to the department from Admiral Benham which contained forty-two errors. It was impossible to make out its meaning, and it was necessary to send the message back to Rio to be put into cipher again and then forwarded to Washington before the authorities knew what was the matter. The last long message received from Admiral Benham was the one in which he gave an account of the firing on the insurgent ships by the Detroit and the protection given two American coffee ships. This message arrived late at night, and while it was not very long, not containing more than 300 words, two officers were busy making out its meaning from midnight until after 4 o'clock in the morning.

While no officer in the navy is permitted, under pain of court martial, to give away any of the secrets of the code, it is learned that the following is in a measure the way a message is put in code and transmitted: For the words in a message it is desired to send certain corresponding numerals are substituted, and these in turn give place to queer-looking words, specially constructed by the officer in charge of the ship and his aids. These words, which are cabled, are simply arbitrary combinations of syllables, having no meaning or significance, except that they stand for the numerals which represent in the cipher code the words of the proposed message. These words and numerals are contained in a limited number of books, one set of which is kept in the office of the Secretary of the Navy, and one book is given to every ship bound for a foreign station. When an admiral is in command, all communications from the secretary and to him are put in cipher and translated by the admiral's aids, and no other officer is authorized to use the code in the fleet. On board ship the book is kept in a heavy leaden case, water tight, and under lock and key. The case is perforated so that should the vessel be taken, one of the first things to be done is to toss it overboard, where it will at once sink and prevent the enemy from securing possession of a very doubtful means of learning the way we communicate by telegraph with our naval officers. The code proper contains in alphabetical arrangements long lists of phrases that cover every sentence likely to arise with reference to naval matters. It also contains the letters of the alphabet, which it may at any time be necessary to use in spelling out unusual words. A list of numbers is also included, and in parallel columns with the phrases, words, letters, and numbers, are numbers composed of five or six figures. It is by the combination of these figures and letters that words are reached which fit certain sentences, so that should a message be sent to Admiral Benham "to proceed without delay home," the message when in cipher would look something like this: "Aemonite, absodete." Give any one the cipher book, however, and he would look a long while before he could get a phrase that answered these words. It is the combination of the letters that creates the confusion and prevents any one but an expert familiar with the code from arriving at the true meaning. All messages to the Navy Department come addressed to "secnav," which translated means Secretary of the Navy. Frequently, however, the name of the secretary is used, as "Herbert, Washington." One great difficulty in using the code is to give a correct message when a proper name has to be used. A few years ago a message came to the department from Admiral Gherardi, on the Philadelphia at San Domingo, saying that he had sailed for New York at once. As no orders had been given to this effect, the secretary was surprised to receive the message. Upon the arrival of the admiral, however, it was found out that he had stated in the cipher that an officer on board was dangerously ill and could not survive while in the warm climate. He had attempted to use the cipher in transmitting the name, and no one in Washington could make out what it was.

While mistakes frequently occur in sending messages, they are almost invariably due to blunders by the operators in foreign countries. The department experiences more trouble with the messages from South America than from any other part of the world. This is due principally to the great number of relays and repetitions necessary to get the message through and the lack of intelligence of southern operators. In communicating with Brazil, either one of three cable lines can be used. The most expensive is found to be the surest and quickest, but greater time is taken to place the message in the hands of our officers. During the Brazilian revolution several messages have been two days on the way and even longer. The expense entailed upon the department has reached as high as $1,500 for a single message. This message was sent to Admiral Brown during the Chilean war, and contained several hundred words. No discount is allowed the government by the cable lines, and it is at the same expense as other parties in communicating messages. The most expensive message received from Rio cost $500. This came early in January, and has not yet been made public. When the Trenton, Vandalia, and two German war ships were lost during the Samoan hurricane, a message was sent from Auckland which cost nearly $1,000. This was more costly, however, than it would have been had the cipher been used, but owing to the fact that the code book was lost with the vessels, every word was sent in plain English. The saving in messages by the use of the code is about three and one-half words to every word of cipher. A

message such as, "You are directed to proceed to Rio and report to the senior officer present," would be translated in about four cipher words. Including the address and signature, therefore, ordinary messages sent directing the movements of vessels can be put into from three to ten cipher words.

When the Navy Department gives out to the press cable messages received by the code, the words are so transposed as to be almost in reverse order to the way they came by wire. In no case is the literal translation of the message given, for the reason that, notwithstanding the complicated character of the cipher, the secretary hesitates to furnish, even to the cable companies, a fragment of the key to the code. Should Secretary Herbert decide to make public a message from Admiral Benham, saying that the Detroit had been sunk in an engagement with an insurgent vessel, the message would be so thoroughly rearranged that the admiral would probably not recognize it himself again.

The care with which the cipher code is guarded by naval officers and the necessity for transmitting important naval intelligence in the code were shown during the Chilean trouble. Admiral Brown having discovered an important move on the part of the insurgents and desiring to communicate the fact to Washington, had a cipher message prepared to be forwarded. This message was written out about as follows:

Secnav, Washington:
Abridero, ajacito, hiberia, abarloais, laufwerc ebascam.
BROWN.

When translated the message informed the secretary that "Admiral Brown reports the landing of 6,000 men at Quinteros Bay, twenty miles north of Valparaiso, and that the government forces were preparing to advance on them." This paraphrase of the message answered every practical purpose, but these curious words would afford little clew to the public had they been given out. In sending his message to the department the admiral was careful to guard against permitting the contents being known to the Balmaceda forces, but the carelessness of the officer filing it at the cable office came near causing serious trouble for the United States government. This officer was in the employ of an American newspaper, and after seeing the cipher message off on the wire he filed a message to his paper, which was a translation of the code message in plain English. The Chilean authorities learned that the message had been sent, and accused the admiral of giving information to the insurgents. Secretary Tracy heard of it, and but for strong political influence and the request of the newspaper editor, the officer would have been court martialed.

Both the State and War Departments have cipher codes, but they are very imperfect in comparison with that of the Navy Department. Throughout the entire Hawaiian correspondence, when instructions were being sent to Minister Willis and when he was answering the numerous questions of Secretary Gresham, the navy code was used exclusively. All of Mr. Willis' messages were put into cipher on the flagship Philadelphia at Honolulu and then sent over on the mail steamers. At San Francisco they were received by the government dispatch agent, who forwarded them over the continent by wire. They were then given to the naval experts for translation. In sending messages to the minister the same method was followed.

It has often been said that officials of the State and Navy Departments engaged in the work of translating and deciphering code messages have been bribed to impart important information to foreign governments. One of the most generally believed of these stories is that at the time of the Virginius affair, when the United States was making demands upon Spain, the Spanish government knew what was going on long before the American minister did. Of course, no proof of the charge was ever forthcoming, and the officials all say that it is impossible that it could be true. Still, stranger things have happened in the government departments at Washington, of which the public has never been informed.—*N. Y. Sun.*

SHIP RESISTANCE.

UNDER the auspices of the Greenock Philosophical Society, on January 19, Mr. R. E. Froude, of London, delivered the Watt anniversary lecture, his subject being "Ship Resistance," which was illustrated by diagrams and lime light views. In the course of his lecture, Mr. Froude said that among the many applications of the invention which we are accustomed to associate with the name of Watt, perhaps one of the most conspicuous is the use of steam for marine propulsion; hence ship resistance suggested itself as an appropriate subject for the lecture. His purpose was to give an outline of the leading principles which enter into the subject, in so far as he himself understood them; those principles which we must in some measure understand and appreciate in order to be able to draw correct conclusions from particular facts of experience, or to predict the effect of any novel feature in a ship or novel characteristic of her form. The most important step to take at the outset is to get rid of the very natural, but nevertheless mistaken notion, that a ship or a fish or other similar body moving through the water experiences resistance mainly and primarily because it has to force the water out of its way. Until thirty or forty years ago the accepted theory of ship resistance, so far as there was any, was based upon this mistaken notion, the resistance being supposed to be due to the inertia of the water so disturbed. According to the now universally accepted theory, in an imperfect fluid such as water a fish or fish torpedo would experience resistance solely in virtue of the frictional imperfection of the fluid, and the degree of resistance would be (at least broadly speaking and presumably) proportional to the degree in which that frictional quality was present. In the case of a ship moving at the surface, the presence of the free surface, so far from diminishing the resistance, only introduces a new element of resistance, due to the formation of waves. Considering the modern theory as it applied solely to the case of a fish or fish torpedo, and dealing thus with submerged bodies, moving at steady speed, what the lecturer represented was, briefly, that fluid resistance is inseparable from fluid friction; that fluid inertia only comes in as a source of resistance in virtue of and, so far as we have yet seen, broadly speaking, in proportion to the effect of fluid friction; and that in an ideally perfect frictionless fluid there could be no resistance at all, whatever the shape of the body. Then, as to a ship or other body moving at the free and open water space, he first noticed that this wave-making resistance is a distinct and additional source of resistance. The general principle of the action by which a vessel imparts wave motion to the water she moves through, and so experiences resistance, might perhaps be best illustrated by means of the closely analogous action of imparting swinging motion to a pendulum by disturbing its point of suspension. What he called the direct wave-making resistance was the item of wave-making resistance which it is most important to study, not because it is by any means always the largest item, but because it is the only one which is critically or acutely sensitive to speed of ship, and is for that reason responsible for all the complication which attaches to the question of the best form of ship for given conditions. We may conclude that lowering the level of any element of the displacement of a ship will be most effective to reduce its potency to develop very oblique wave making, yet, at the same time, up to a certain point, will not materially reduce its potency to develop direct wave making. And herein we seem to find the true explanation of the effect which the V bow with fine water line has been found to possess as compared to the V bow with fuller water line, specially to diminish the oblique wave-making resistance. For it is only just at the bow, and in a minor degree at the stern, that the statical wave of a shipshape form presents features conducing to the formation of the very oblique waves of short length crest to crest.

THE HYDRO-PNEUMATIC EJECTOR.

WE do not remember anything of a more simple nature than See's Patent Hydro-Pneumatic Ejector, which we illustrate in the adjoining diagrams, for hoisting ashes from the stokehold on board a steamer. Referring to these diagrams, Fig. 1 is a side elevation of the apparatus, Fig. 2 is a plan of the same, and Fig. 3 the section of a steamer showing the apparatus fixed in place with the delivery pipe overboard.

The apparatus consists of a hopper into which the ashes to be thrown overboard are shoveled, and which is placed a little above the boiler room floor, the bottom of the hopper is connected to the ejector, which has suitable connection from a pump and also a discharge pipe leading upward and outward to the side of the vessel above the water line. The hopper is provided with a hinged lid, which makes a water-tight joint upon the same by means of suitable clamping screws. A regulating cock or valve is provided on the pipe from the pump, and a drain cock is situated at the lower portion of the discharge pipe. When at rest the lid of the hopper is kept closed, and the jet cock as well as

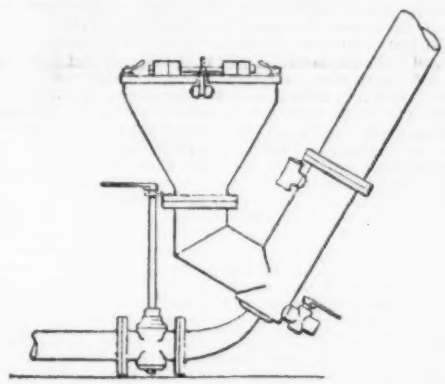


Fig 1

the drain cock are kept shut. When it is desired to work the apparatus, the steam is turned on to the pump. After sufficient water pressure has been obtained in the pump, the jet cock is opened and the lid of the hopper raised.

The only work now to be performed by the firemen is that of shoveling the ashes into the hopper. The ashes in their fall through the hopper encounter the jet of water from the pump, and are forced up and out of the discharge pipe some distance clear of the vessel by the combined action of the dynamic effect of the jet of water and the induced draught of air produced by the same.

After the work is completed the lid of the hopper is closed and secured before the pump is stopped. This, however, is not absolutely necessary, for the reason that if the jet cock is closed very suddenly the whole of the water in the discharge pipe is carried out there-

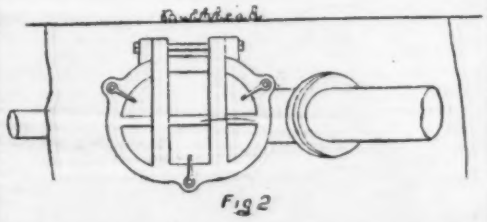


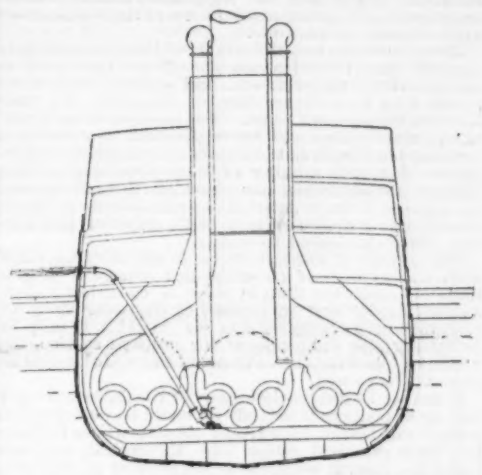
Fig 2

from by its own momentum, leaving the hopper, ejector, and discharge pipe practically empty.

The ashes being thrown out in a liquid condition with great force clear of the vessel, no matter what the state of the weather may be, they will not be deposited on any part of the vessel, either above or below the water line, and thus passengers passing fore and aft will not be soiled or drenched when the ashes are being discharged.

One of the important features which the apparatus possesses is that it takes up little room and can be placed in positions where it would be impossible to introduce apparatus under any of the old methods.

It prevents one of the fruitful causes of trouble between firemen and sailors, and obviates the necessity of calling the watch to assist in removing the ashes, and on whatever ship it is used it saves the firemen one of the hardest and most wearisome of their duties.



THE HYDRO-PNEUMATIC EJECTOR.

It has been placed upon a great many steamships, and its use is attended with marked success in every case.—*Marine Engineer.*

AMERICAN MEN FOR THE NAVY.

PRESENT conditions in the Hawaiian Islands and in Brazil must incline citizens most conservative as to our foreign policy to feel that the United States Navy ought to be strengthened.

New men-of-war should be built after the best designs by competent naval constructors. They should be officered by able men, guarded by well-drilled and equipped marines and manned by a crew less heterogeneous and more American than that to be found on some of the vessels now in service.

F. M. Bennett, passed assistant engineer in our navy, in a recent valuable and suggestive article in the *United Service*, states that the Enterprise sailed from New York in 1887, with a crew, exclusive of officers and marines, numbering 138. Of these only 73 were native-born Americans. This is a much better showing than that made by the ill-fated Ashuelot, when she went down in the China Sea eleven years ago. Among her 111 men, exclusive of marines, twenty nationalities were represented and only 19 men were natives of the United States.

Mr. Bennett has taken pains to collect statistics like these, and in his article on "American Men for the Navy" shows good grounds for change in the service and the basis upon which a change may be made.

He says: The *materiel* of our navy has completely changed in recent years, and, with only a few exceptions, our new ships have decided national characteristics; they are not only American in design and construction, but they carry with them that peculiar something in style and appearance that distinguishes them in foreign ports from the warships of all other countries, just as the Yankee dash and swing distinguishes the American abroad from the Frenchman, the Russian, or the Englishman. Rare specimens of the American naval officer, it is true, seek to disguise their nativity by the cultivation of a transatlantic accent; but there appears no good reason why the whole service should follow suit by disguising our national vessels with foreign-tongued crews. Our ships, engines, and guns are thoroughly American, and it is high time that the crews were Americanized by so modifying present naval practices as to make life on a man-of-war possible and even attractive for our citizens. Theories must be laid aside and some practical method put in operation whereby an American youth can find in the navy of his country an opportunity for a career at least equal to that open to him in trade or in the mechanic arts.

To Americanize the service and make it sufficiently attractive for our native-born citizens to take it up as their career in life several propositions must be enacted into laws and put in operation; chief among which may be cited the following:

1. The possibility of enlisted men becoming commissioned officers.

2. An increase in the number of warrant officers, and restricting appointments to this class to the petty officers of the navy.

3. Increased responsibility and dignity of position conferred upon petty officers on board ship.

4. A retired list, or civil employment on shore, for enlisted men after long and faithful service.

5. More attention given to the comfort of enlisted men in the design of ships and in the administrative details of life on board them.

Regarding the first proposal, we would do well to adopt either the French or the English system of advancing warrant officers, previously described, preferably the French system. The details of this system when put in operation would involve certain restrictions as to age, length of service, conduct record, etc., and promotion would depend upon passing a professional examination. As is the case in France, opportunity should be given candidates to fit themselves for the theoretical part of the examination by the establishment of a preparatory school at the Naval Academy or at one of the navy yards.

A certain proportion of the vacancies occurring in the rank of ensign each year should be regarded as belonging to this class of candidates, and the examination of warrant officers should be held earlier in the year than July 1, in order that graduates of the academy could be assigned to such of these vacancies as remained unfilled after the successful warrant officer candidates had been commissioned.

In connection with this subject of advancing warrant officers to commissioned rank, consideration for the engineering force should not be lost sight of by allowing it to be overshadowed by the larger and more prominent seaman class. A grade of warrant-officer-machinist should be created for the artificer branch of the service, into which enlisted machinists could be advanced under rules and regulations similar to those practiced in advancing petty officers of the seaman class to the dignity of warrants.

These warranted machinists should be on an absolute equality with the other warrant officers in regard to pay, quarters, uniform, etc., and equally with them should they have the privilege of competing for commissions in their own corps. The number of such warranted machinists could be established by making it bear the same ratio to the number of commissioned engineers that the number of seamen warrant officers bears to the number of commissioned line officers, and the number of them entitled to commissions annually should bear a similar ratio to the number of line warrant officers advanced to ensigns.

The number of warrant officers in our navy compared with the number of commissioned officers is proportionately much less than in some of the other well-organized navies, and by increasing the number by advancing worthy petty officers we would not only be increasing the inducements for enlisted service, but would be following the example of successful naval organizations as well.

It cannot be denied that many of the duties now falling upon commissioned officers could be performed as well, if not better, by warrant officers, whose training has been practical rather than theoretical, and this being the case, it would be in the interest of efficiency as well as economy to gradually replace many of the commissioned officers now in the service by the less ornamental but more useful warrant officer.

The matter of the comfort of the men, and sometimes of the officers, on board ship is not given sufficient consideration by the designers. Of course a war ship *must* fulfill several important conditions as to speed, coal endurance, weight of battery, etc., but the comfort of the men who have to handle and fight the ship, a matter that directly affects the efficiency of the whole fabric, is too often made subordinate to everything else, or is even not considered at all. Officers familiar with ship life know that a crew that is comfortably messed and berthed is a good crew, and that one in which the men have to swing two or three deep and to "wolf" their food out of tin pans on the deck is an uncomfortable, discontented, and poor one, which no amount of drill and training can make really efficient.

A few words as to the proper source of supply of seamen for our new navy will not now be out of place. There is a popular belief throughout the country that men who dwell along the sea coasts constitute the only element fit for service in the navy, a belief that was essentially correct so long as sails were the motive power of war ships, but is now sadly out of date. Although sails have now passed away for naval purposes, there is still a powerful faction in the navy that clings to this old idea, and by giving it publicity serves to discourage the very element that we most need from entering the service.

Only a few months ago it was stated in a letter published in this magazine that the proper element to draw upon for sailors to man ships in case of war "is found among fishermen and stevedores." It is high time that this idea is exploded; fishermen and stevedores may have been excellent material for men-of-war's men in the days of sailing frigates, but that day is now done. The man on shipboard now, whatever his rating may be, who can weld the broken ends of an iron bar is infinitely more useful to the ship than is the man who can splice a rope. In dealing with this same subject of seamen for a modern navy, that eminent French authority, the late M. Gabriel Charmes, wrote as follows:

"Even if born on a sailing ship, a native of the coast would not any the more be fitted for handling the engines than any ordinary conscript. The complicated engines on board a modern vessel would puzzle him quite as much; he would be just as awkward and just as difficult to teach. To have breathed the sea air from his earliest youth would avail him nothing. Long cruises, interminable voyages which could only be endured by those accustomed from youth upward to live between sea and sky, have given place to a new style of navigation exacting more intelligence than strength or perseverance. In this way the best seamen are as often secured by conscription as by maritime inscription, or rather a great many more are secured by the former than by the latter. The townsman makes a better gunner than the fisherman does, and is still better if he happen to be a workman or a mechanic."

When it is understood by the public that the mill men of Pittsburg and Birmingham or the engine builders of Detroit and Milwaukee are wanted in the navy in preference to the fishermen of New Bedford and Marblehead, we may hope to get men who will not be entirely fish out of water in the complicated compartments of a modern war vessel and who, under the direction of a gun captain who is a machinist rather than a sailor, will not ruin the fine mechanism of a gun mount by scrubbing it with sand and canvas "to make it shine." No disrespect is meant in these remarks to the seafaring class of our citizens, which class under a different order of things for a long period maintained the honor of our flag at sea. Such communities as that of Marblehead, for instance, which brave little town once contained six hundred widows as a result of the American revolution, and furnished almost all the men of the frigate Constitution during her glorious career in the war of 1812, may well rest on their laurels and accept the truth that the service has so changed as to need a different order of men to-day than they can supply.

F. M. BENNETT,
Passed Assistant Engineer U.S.N., Member of the Society of Sons of the American Revolution.

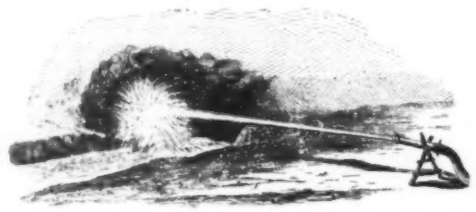
COTTON cloth was first made in India, and was in use there as early as 2,343 years ago. About the year 450 B.C., Herodotus spoke of this textile fabric, made from the trees of India which bore, as their fruit, fleeces surpassing in beauty and delicacy those of the sheep.

HYDRAULIC MINING.*

Water-Distributing and Gravel-Washing Apparatus.—While the dam and the ditch with its appurtenances are being constructed, the gravel-washing and the gold-saving implements and apparatus should be gotten on the ground and put in place, the point where they are to be located being immediately under and in close proximity to the lower end of the ditch. At its lower extremity the ditch empties itself into a section of flume, at the end of which is situated the bulkhead or pressure box, a large oblong receptacle, built of strong planks and so called because the head or pressure of the water is here measured.

Connected with or located immediately above this structure is the sand box, a square compartment sunk several feet below the floor of the flume, the design of this box being to catch any sand or fine gravel coming down the ditch, such material, when it reaches this point, falling into the sink, being the depressed portion of the box, and is there retained. Through a gate at the side of the box this stuff is discharged as often as its accumulation makes it necessary. If much sand is allowed to enter the sand pipe, it tends to impair the efficiency of its action.

The pressure box, with a width of about six feet, varies in length from ten to thirty feet, a greater length being required when it has two feed pipes to supply, also where the sand box forms a part of it. For the sand box a wooden apron is placed in the bulkhead and so arranged that it catches the sand and drops it



GIANT PLAYING ON CAVED BANK.

into a chamber below, which is supplied with a discharge gate. A gate is set at the upper end of the pressure box to prevent any floating stuff entering it. There should be water enough in this box to cover the supply pipe to a depth of several feet, that no air, or as little as possible, be carried into it, to which end this box is usually divided into two compartments, the water being brought into a placid state in the upper before it enters the lower one. That the water supply and exhaust be kept in equilibrium as near as may be, a waste gate should be placed in the flume above.

The main supply pipe starting from the bulkhead should descend to the washing pit with as few deflections, rises or depressions as possible, as these not only tend to retard the passage of the water through the pipe, but also promote the collection of air within it, rendering an explosion imminent. To obviate this at all times, and to guard against it when filling the pipe, at which time it is much increased, air valves are to be placed at suitable intervals along it. All large water pipes should be equipped with a sufficient number of air valves, these escapes being provided with brass floats, as the wooden ones are apt to swell, and becoming wedged in the valves, the pressure of the air without is insufficient to press them down. When the bank down which the pipe has to be carried has much inclination it should be placed on a stout framework, and, besides being braced on both sides, should be heavily weighted with bowlders as a security against any movement, which, should it occur, might cause much inconvenience and possibly serious damage.

This pipe for several joints at its upper end is much enlarged to insure a more free admission of water. Below that point it is all the way of uniform size, or as far down as the junction of the branch pipes, if any there are. In early times the letting on and shutting off of water was effected with a wooden gate, raised and lowered by means of a lever. For this crude and clumsy contrivance there has now been substituted in all large works the heavy cast-iron gate operated by a screw, powerful and easily manipulated. Everywhere now, on the dams, ditches and reservoirs and in the washing pits, these improved structures are in use, differing but little, except in size, and in this according to the service required of them.

A powerful machine of this kind is employed for admitting and shutting off water at the entrance of the main feed pipe. In the performance of this task care should be taken to let on the water gradually, as too great a rush might carry in so much air as to cause a disaster, this being a precaution to be always observed under similar circumstances.

The size of the feed pipe depends on the quantity of water to be transmitted through it, a pipe 22 inches in diameter being sufficient to pass anywhere from 1,500 to 2,000 miner's inches. When the quantity of water ranges from 3,000 to 4,000 inches a 30 inch pipe should be chosen, the friction caused by the passage of the water being less, comparatively, in large than in small pipes. The iron used in the construction of these pipes varies from No. 16 to No. 11 and lower, according to the pressure to which they are to be subjected. For a 22 inch pipe No. 16 iron is usually employed for pressure up to 150 feet; No. 14 from 150 to 200 feet, and No. 12 from 200 to 300 feet, the latter being about as great a head as the water is apt to be used under in hydraulic washing. For a 30 inch pipe No. 14 iron has been found to answer for pressure up to 150 feet, and No. 12 from 150 to 275 feet.

Before being placed in position these and all other iron pipes to be used in connection with hydraulic mining should be immersed in liquid asphalt, such as is now being manufactured for this and similar purposes. Coal tar, with which these pipes were formerly coated, is now giving place to the asphalt preparation, it having been found equally cheap and more efficacious.

Formerly the lower end of the feed pipe was connected with what was known as the distributer, a short cast iron box firmly anchored in the washing pit, the duty of which was to receive the water brought in by the feed pipe and distribute it to the several smaller pipes that lead to the giants or monitors, the number of these pipes corresponding with that of the machines to be supplied with water. Being ponderous, costly and liable to burst, the distributer has come to be pretty generally discarded, the plan of connecting all distributing pipes directly with the main feeder, as now practiced, having superseded it.

The accompanying plate presents a general view of a portion of the gravel-washing and the gold-saving appliances located in and below the washing pit.

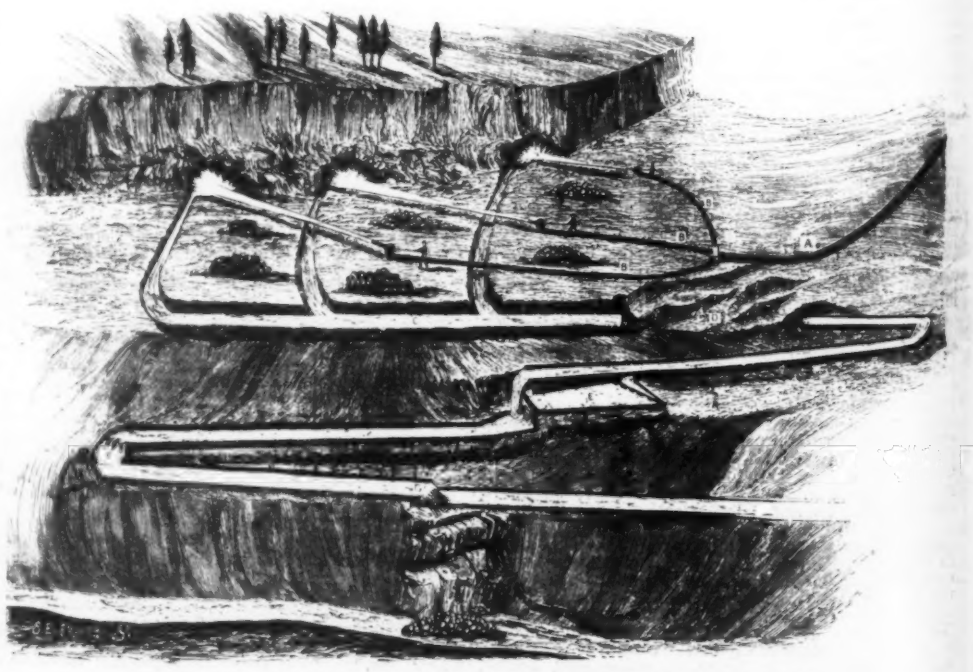
To that part of the hydraulic apparatus connected with the final discharge of the water through nozzles, various names have been applied, such as the "goose neck," "globe monitor," "dictator," "deflector," "knuckle joint," "little giant," etc.

While certain of these names are suggestive of some property, feature or other peculiarity of the machine, more of them would seem to have no special significance; although for each of these devices the inventor has claimed some peculiar merit, and not always without reason, only a few of the entire number are now much in use.

For the information of those not posted in these matters it should be explained that, in miner's parlance, the terms monitor, nozzle and giant mean all the same thing, they being applied to these several machines indifferently, and in the case of the nozzle, very improperly, as this is only an appendage of the apparatus, being only the projecting tube or nose through which the water makes its final escape. There is need for a specific name for these discharge pipes, which should designate and be confined to that portion of them by which these movements are directed and controlled, and thus the present confusion be avoided.

These pipes range from four to nine inches inside

* This article was prepared by the late Dr. De Groot for the Eleventh Report of the State Mineralogist, just issued; but its publication with that of much other valuable matter was prevented by the necessity of revision and omission, so that the volume might be reduced to reasonable limits. It covers familiar ground, but is, on the whole, a complete and careful review of the industry and hydraulic mining methods. The article has been furnished to *The Mining and Scientific Press* by State Mineralogist J. J. Crawford.



HYDRAULIC MINING—GENERAL VIEW, SHOWING THE PLANT.

A, main pipe conducting water from bulkhead to distributer; B B B, distributers; C, sluice; D, rim-rock tunnel; E, undercurrent; F, drop; G, grizzly.

diameter, the quantity of water they are capable of discharging varying from 300 to 1,500 miners' inches of water, according to size, pressure, etc. They can throw an effective stream on a gravel bank 200 feet away. Frequently as many as four, and even five, of the largest sized machines are played in a single pit at the same time, each machine discharging from 1,500 to 1,700 cubic feet of water per minute. Notwithstanding the force of one of these large jets of water, so indurated or so tenacious are some portions of the gravel to be washed that it has to be shattered with powder preparatory to playing the water upon it. The force of a large stream of water as it issues from one of these nozzles is hardly less than that of a cannon ball at the instant of its discharge. When operated the machine is brought as near the bank as is compatible with the safety of the pipe man, in order that the full effect of the jet may be obtained. When the bank is very high, fatal accidents sometimes occur through its sudden caving. When much over a hundred feet in height, the bank is piped off in benches as a safeguard against accident caused by these caves. The manner of piping off a cave is shown in the figure.

When it is said that a full set of the largest of these machines, as we sometimes see them operating in the hydraulic mines, is capable of performing the work of a thousand men, the remark is to be understood in a literal sense.

NONSUCH PALACE.*

OF all the suburban palaces of our English sovereigns none has left behind it such a reputation for luxury and magnificence as Nonsuch. Leland says of it:

"Hanc quia non habent similem laudare Britanni
Sæpe solent nullique parem cognomine dicunt."

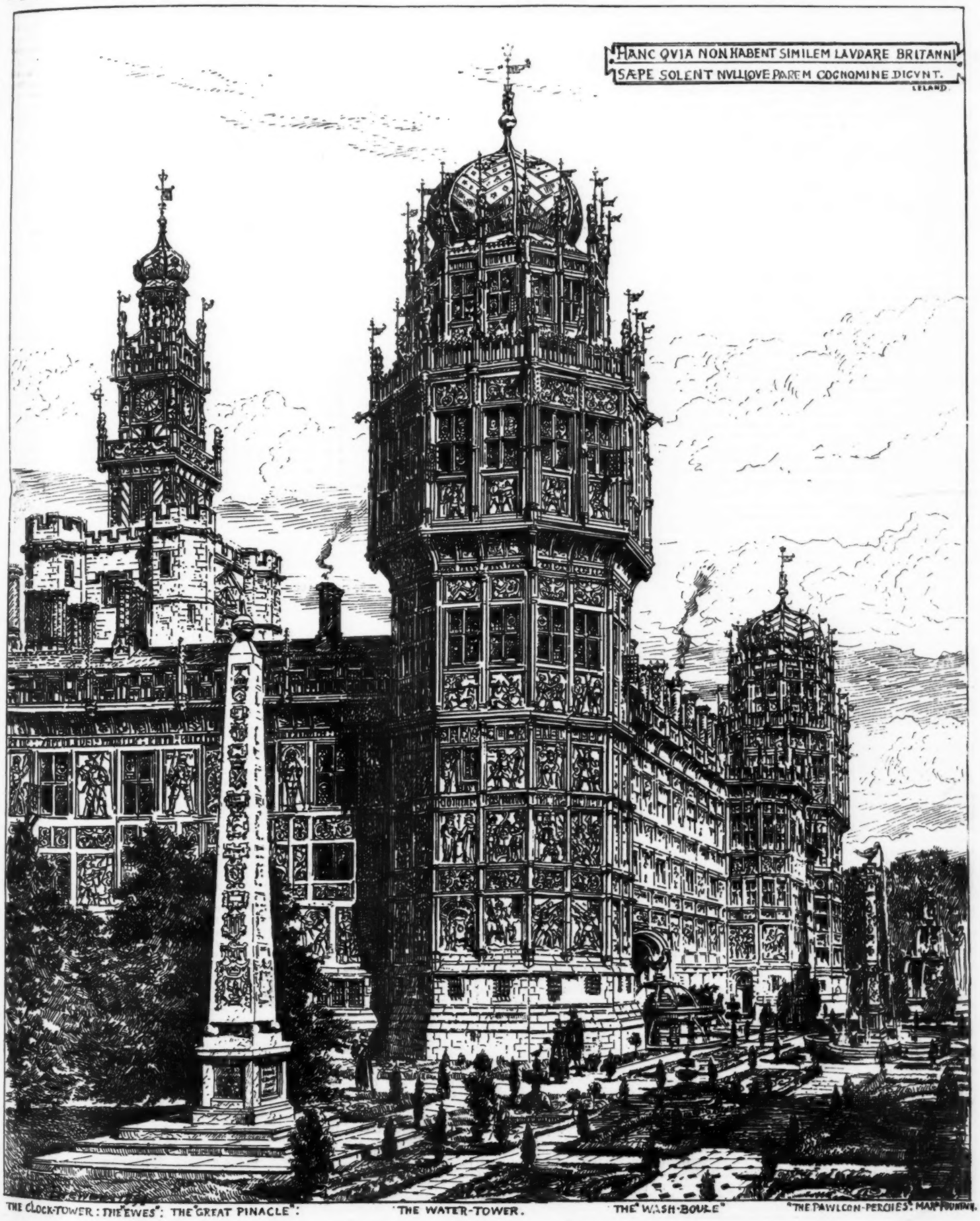
"Unrivaled in design, the Britons tell
The wondrous praises of this nonpareil."

Not one stone of this splendid palace now exists, and its very site can only with difficulty be traced; but fortunately we have two fairly good old views of it. The first is an engraving by Hofnagle, dated 1582, and published in George Brown's "Urbium Præcipuarum mundi Theatrum," and the other is a much smaller, but I think more valuable engraving by Jodoc Hondius, dated 1610, in "Speede's Surrey." Both of these views represent a kind of elevation of the garden front of the house, with the outer court, in rather singular perspective, showing over it. Hofnagle's view only shows the upper part of the building, the lower portions and the interesting gardens being concealed by a high garden wall; but in Hondius' view this wall is omitted, so as to show the whole building and the garden with its very curious fountains and other structures.

Both of these views are more or less impossible and purely conventional in treatment; but with the help of the various descriptions remaining of the building, more especially the survey made by Cromwell's commissions in 1650, one is able to realize what this royal palace was like in its palmy days.

As Nonsuch was only commenced in the eighteenth

* From the *Builder*, London.


HANC QVIA NON HABENT SIMILEM LAVDARE BRITANNI
SÆPE SOLENT NVLLIQVE PAREM COGNOMINE DICVNT.
LELAND
THE CLOCK-TOWER: THE EWES": THE GREAT PINACLE":
THE WATER-TOWER.
THE "WASH-BOULE"
"THE DAWLCON-PERCIES": MAIN FOUNTAIN.

NONSUCH PALACE—A RESTORATION BY MR. H. W. BREWER.—*From the Builder.*

year of the reign of Henry VIII. (1537), and was totally destroyed by order of the Commonwealth in 1650, it cannot, of course, have taken a very important position as a historical edifice.

Henry VIII. does not seem to have completed it, as it was purchased in an unfinished condition by the Earl of Arundel in Queen Mary's days. Henry, Earl of Arundel, is said to have spared no expense in completing the house and gardens. It seems to have passed again into the hands of the crown in Elizabeth's time.

The palace seems, somehow or another, to have passed into the hands of Lord Lumley, son-in-law to Lord Henry Arundel, but it was again sold to the crown in 1591. The last royal person who inhabited it was Henrietta Maria, Queen of Charles I. In the survey taken by the commissioners in 1650 it is described as "late percell of the possessions and joynture lands of Henrietta Maria the relict, and late wife, of Charles Stuart, King of England."

Nonsuch Palace was situated near Cheam, in a village called Cuddington, which village, together with its church and manor house, would appear to have been destroyed to make way for the palace with its park and gardens.

The buildings surrounded two courtyards. The outer or lower court measured internally 150 ft. by 132 ft., and the inner or upper court was 137 ft. by 116 ft. The "outer court" was upon a lower level than the "inner court," and there was a rise of eight steps from one to the other. Between the two stood a gate constructed of freestone three stories high, with embattled turrets at the angles, and crowned by a lead-covered tower to hold the clock, which clock and tower are said to have been "of most excellent workmanship and a special ornament to Nonsuch." There was a little court to the east which contained the kitchens and other offices. The larger or outer court was two stories high, embattled, and constructed entirely of freestone. It contained the lodgings of the almoner, chamberlain and other attendants upon the queen, and also the buttery, wine cellar, etc.

And now comes a singular fact: although the lower or outer court, which was only inhabited by court officials and servants, was constructed entirely of freestone, the portion of the edifice containing the royal and state apartments, the "upper court," was built of wood, except the basement; or perhaps, to speak more correctly, it was framed in wood, no doubt "post and pan" work. It would, however, appear that the wood was not visible outside, because we are informed that this part of the building was "battled" (embattled) with frames of wood covered with lead and supported with strong bars of iron, "which battlements are a great grace and a special ornament to the building." The two great towers at the southeast and southwest angles of the building were also embattled with lead, and their lanterns were covered with the same material. The southwest tower (that shown in the foreground of our drawing) was the water tower. It contained a vast cistern of lead "of so singular a use that pipes being branched from thence supply the offices and the whole house with water." In fact, water was regularly laid on as in a modern house. It would be interesting to know whether this was the first house in England with a regular water service.

The whole of the walls of the upper building, except the basement, were covered with a series of bass-reliefs in plaster representing figures and various scenes. It has been stated that these were composed of "rye dough."* Now, although rye dough may have entered into the composition, as it does into that of some modern kinds of stucco, yet, of course, it would not be sufficiently hard or white for the purpose alone. The German black bread does certainly get hard when stale, but if you soak it in water for a month or two it can be eaten in soup, but we never heard of its being used for building. There is, however, a passage in Leland quoted by Lysons which seems to offer some solution of the difficulty. Leland says that at Cuddington, where the king (Henry VIII.) was building, "is a vaine of fine yerth, to make moldes for goldesmithies and casters of metale, that a loade of it sold for a croune of golde. Like yerth to this is not found in all Englande." Now, may not this "yerth," when mixed with the rye dough, have formed a fine hard plaster or stucco, in which these figures were either modeled or cast?

The gardens of Nonsuch Palace seem to have been as remarkable as the building itself. The principal garden appears to have surrounded the three external sides of the inner court, and probably from the fact that the private chambers of the king and queen overlooked it was called the "Privy Garden." The survey informs us that there was "a large garden called Privye Garden" lying round and adjoining into the three outsides of the inward court building—inclosed by a brick wall 14 ft. high, cut out and divided into alleys, quarters and rounds, set about with thorn hedges. "In the said garden there is one piramede or spired pinacle of stone," and near which, against the west turret, is placed one "large marble 'wash-boule,' over which stands a marble pelican fed with a pipe of lead, to convey water into the same. There are also two other marble pinacles or piramedes called the 'Powlcon perches' (falcon perches), between which a fountain of white marble with a lead cistern, which fountain is set round with six trees called *leylack trees*, which trees bear no fruite, but only a very pleasant flower." There are also "in the said privey garden one hundred and forty fruit trees, two ewe trees, and one juniper tree," etc.

These fountains and the large stone pinnacle are all shown in the view by Jodoc Hondius. Probably the account given by Hetzner, who visited the place in Elizabeth's time, is not much exaggerated; he says that it was built "with an excess of magnificence and elegance even to ostentation; one would imagine everything that architecture can perform to have been employed in this one work; there are everywhere so many statues that seem to breathe, so many miracles of consummate art, so many casts that rival even the perfection of Roman antiquity, that it may well claim and justify its name of Nonsuch, being without an equal, or, as the poet sings:

> This which no equal has in art or fame,
> Britons deservedly do Nonsuch name." H. W. B.

* Lysons' Environs of London, p. 111, note 56. Second edition.

[From the Builder.]

WESTMINSTER ABBEY.*

IT is an impossible task to attempt to describe the monastic buildings fully. It may suffice to say that at the dissolution of the monastery the buildings were subdivided to form houses for the canons. No systematic rebuilding has ever taken place, but changes for individual convenience have constantly taken place, sometimes to reveal a curious feature of old work, sometimes to cover it over for centuries; and alas! sometimes to destroy it. The little cloisters open from the confessor's work by a wide passage, the two arches to carry the walls overhead being ancient, and the barrel vault of recent date. The arches inclosing the cloister garth are of brick, probably the work of Wren, the wrought iron gate being of passable design. The walls of the inclosure are of fourteenth-century date, built, to a certain extent, of very small stones, in which may be noted some freestone with signs of former use, notably the shaft of an early column next to Mr. Cheadle's door. At the south end of the west walk an early Norman window has recently been laid open. Its purpose was apparently to ventilate the sewer referred to. Above it is a curious piece of ancient construction. The ashlar work is arranged in squares laid diagonally, and between a course similarly laid, worked in dark stone.

These cloisters occupy part of the site of the infirmary, which opened into the infirmary chapel, which was dedicated to St. Catharine. Perhaps even the nave and aisles formed the infirmary either wholly or in part, the chancel being screened off as the chapel. The outlines of the walls and the bases of the shafts, hidden more or less by modern brickwork, alone remain. They were cleared to the extent seen a few years ago. They are of late Norman date.

The Jerusalem chamber and adjacent buildings formed the abbot's house, some of these being now included in the deanery. The former chamber contains an admirable Elizabethan chimney piece, and in the large window are some roundels of Norman stained glass inserted. The long table in what was formerly the abbot's hall is said to have been made out of some of the wreck of the Spanish Armada.

Some of the curious Elizabethan paneling in the neighboring rooms would be all the better if it were cleared of its many coats of paint.

The present entrance to the cloisters on the west formerly led into the conversation parlor, and over it, very probably, was the guest chamber, or one of the guest chambers and its chapel.

The materials of the abbey demand a passing note. The walls of the confessor's work show a large amount of Caen stone, ashlar, and dressings, as we have already seen, backed up with rubble, the walls being of great thickness and solidity. The later works have walling of Kentish rag, variously squared and laid, the bulk of the dressings being of Reigate or similar freestone, backed up with rubble, doubtless derived from the former buildings as far as it would go, the whole mass standing, not upon a feeble foundation, as is so usual in ancient churches, but upon a solid mass of concrete and rubble of considerable but varying depth.

This mode of construction was all the more necessary, since much of the subsoil is very loose sand; a good foundation when subject to compression, but which is liable to flow in a stream when dug through. Much of the confessor's work was doubtless broken up to form this mass. The floor level, after so many years of the rise of the external ground, is still in good proportion to it, indicating that it must have been once well above the present ground line.

A few blocks of unknown stones are occasionally met with, but the names of most can be determined. It may be worthy of remark that much of the work of the latter part of the fourteenth century is of Roche Abbey stone. A good deal of the cloisters is formed of it. It was used again in Abbot Islip's work. A single block of Quarr Abbey stone has recently been found high up in the walling by Mr. Wright. It had formed part of some Roman building, for red mortar still adheres to it.

Some few of the mediæval bases had plinths of Portland stone, although the use of this material in London is supposed to date only from the seventeenth century; most of the later works of that century and since were done with Portland stone. The recent ones have varied, Chilmark stone being now used for the present works of refacing in progress on the south side.

From the crossing eastward to the chapel of Henry VII., the abbey is a vast storehouse of mediæval monuments, exhibiting some of the choicest specimens of workmanship in stone and metal, sadly desecrated, it is true, and despoiled of the many jewels that once added so much luster to the shrine of the confessor and its surroundings, but still a magnificent series. Besides these are a very large number of monuments of the Renaissance period, very stately, and often highly enriched with decorative work and heraldry, but their erection against the outer walls of the chapels entailed the removal of the delicate mouldings and carving of the arcarding, and, however much we may admire the beauty of some of the monuments themselves, it cannot but be regretted that greater respect was not shown to the mediæval work.

The confessor's shrine and the royal tombs immediately surrounding it form a valuable series of monumental examples from the time of Henry III. to Henry V., including mosaic work, metal work, alabaster and stone carving in great variety. The mosaic has been much destroyed, both on the shrine and the tomb of Henry III., but enough remains on the twisted columns of the former, and on the north side of the latter, to give an idea of the once gorgeous effect of these two examples, the earliest of the series. In strange contrast is the perfectly plain tomb of Edward I., without carving or effigy, situated immediately westward of Henry III.'s monument in the northwest angle of the Saints' chapel. This monument is the only one remaining without decorative treatment, each of the others having some special point of interest. Queen Eleanor's beautiful monument, now much defaced, with brass effigy and elaborate wrought iron grille, remarkable as being of English workmanship; the tomb of Queen Philippa (1369), with its elaborate canopy

* Continued from SUPPLEMENT, No. 948, p. 15145.

work in alabaster, remaining on its south side facing the ambulatory, and the larger one over the head of the recumbent effigy; Edward III.'s monument, a late fourteenth-century tomb, having a wooden canopy, and a brass effigy, inscription, and mourners on the south face; and, finally, the much defaced monument of Richard II. and his queen, the canopy over painted with a representation of the crowning of the Virgin.

The tomb of Henry V. has fared worse than the others, and the rough wooden effigy has lost its covering of silver. The wrought iron gates are noticeable, and the elaborate canopy and figure work of the chantry itself; the altar was that of the Annunciation.

In the floor of the Saints' Chapel, immediately below the back of the altar screen, is some of the "Opus Alexandrinum" and a brass of John of Waltham. East of the shrine is a slab with inlay of red and white mosaic, and a marginal inscription in Lombardic characters.

The beauty of the royal monuments is, perhaps, excelled by that of the tombs north of the sanctuary—all of the decorated period—commemorating Aveline of Lancaster (1273), daughter of William de Fortibus, Earl of Albemarle, and married to Edmund Crouchback, Earl of Lancaster, whose monument is the most easterly of the three. He died in 1296. The third tomb, that of Aymer de Valence (1323), is thus slightly later than the Crouchback, and of smaller dimensions on account of the space already taken up by Aveline's tomb. All three are covered with detail and foliage of the most exquisite kind, and a row of mourners on the ambulatory or north side deserves careful study. The spandrels of Aveline's tomb are particularly beautiful. The monuments in the chapels surrounding the Saints' chapel, and forming the *chevet* round the apse, are of great variety and interest. They cover a period from the thirteenth century to the late Renaissance, and in one or two instances bringing examples of monumental work down to our own day. Marble work, mosaic, enameled metal, and carving and effigies in marbles and alabaster are all represented. The first chapel on the north side is that known as Abbot Islip's, with a loft over containing the wax effigies which were carried in front of the coffin at the funeral of those represented. The front of the chantry toward the ambulatory is a perpendicular design of two stories, the lower portion pierced and admitting of a view of the chapel proper. The upper part is tabernacle work, forming a screen to the upper story, the string dividing the two being ornamented with Islip's name and rebus. His initials and a rebus are also on the wall over the entrance to the Chapel of St. Erasmus, which virtually forms a vestibule to the first of the octagonal chapels, that dedicated to St. John the Baptist. Three tombs with effigies of no particular merit in themselves divide the chapel from the ambulatory, and commemorate Bishops Colchester, Reithall, and George Fascet, Abbot of Westminster, 1498–1500. This latter has a stone canopy over it, and in the cornice moulding is one of those excellent examples of a decorative monogram in which the mediæval carver excelled. Against the north wall, standing in front of the arcade, is a small arcaded tomb, with little ornament but a delicate series of caps and trefoiled arches, said to be to the memory of Hugh and Mary de Bohun, c. 1300, children of Humphrey de Bohun, Earl of Hereford. In the center of the chapel, taking up a large amount of its floor space, is the monument of Thomas, Earl of Exeter, who died 1622–23, a very large altar tomb in black and white marble with effigies of the earl and his first wife. The marginal inscription is a good example of simple lettering, boldly designed, and round the tomb are several shields of arms.

The Hunsden monument, against the eastern wall of this chapel, is the most gorgeous and the largest of the Renaissance monuments in the Abbey. It reaches to the level of the springing of the chapel windows, and is a marvel of workmanship in marble and alabaster, and among its decorations are a series of shields showing the family connections, fine examples of heraldic carving. The early wall arcading in this chapel, where not destroyed by the insertion of the monuments, is worthy of notice, also the vaulted vestibule known as the chapel of St. Erasmus. Next in order is the chapel of St. Paul, interesting chiefly for the fine altar tomb of Sir Gyles Daubenay and his wife (1507 and 1500 respectively), who was Lord Chamberlain to Henry VII. The altar tomb is of Purbeck, the effigies of alabaster, elaborately colored. Round the tomb are a series of shields with the arms of the family and their connections, the whole being inclosed within a wrought iron railing of excellent design, with standards at the angles, ornamented with the Daubenay badges. Altogether this is one of the best and most perfect specimens of its date remaining in the Abbey.

Forming part of the screen between the chapel and ambulatory is a Bourchier tomb with banners supported by a lion and an eagle, good specimens of mediæval heraldic carving, and deserving to be carefully drawn before they become more decayed. The other monuments in this chapel are of the Renaissance period, and are not such as to call for any special mention.

The two corresponding chapels on the south side of the ambulatory contain a larger portion of early to late monuments. The chapel of St. Edmund is particularly rich. Here are the effigies of William de Valence, of wood incased in metal, with the well-known enameled shield charged with the Valence arms. The figure rests on a wooden tomb, in its turn carried by a stone base with the arms of the family and of England. On the opposite side of the doorway into the chapel from the ambulatory is the tomb of John of Eltham, a beautifully modeled effigy in alabaster, the sides of the tomb retaining a large number of the "mourners," little statuettes, in this case excellent examples of the costume of the period. Close by this latter tomb are the children of Edward III., a small tomb, with the effigies recumbent on it, of William of Windsor and Blanche de la Tour.

In the center of the chapel on low tombs are three magnificent brasses, that of Eleanor de Bohun (1399) being by far the finest and the most perfect of those remaining in the Abbey. The workmanship of the brass effigy, canopy and shields is of the highest order. Adjoining this is another large brass commemorating Archbishop Robert de Waldeby (1397), also represented under a canopy. The third is to Sir Humphrey Bourchier, killed at the battle of Barnet, with a good example of mantlings and beaume. Behind this in the

wall is a tomb of Sir Bernard Brocas, having a recumbent effigy under a canopy. The tomb of Frances, Duchess of Suffolk (1559), is a marble altar tomb with recumbent effigy, notable for its heraldic work.

The remaining chapel—that of St. Nicholas—has a good stone perpendicular screen dividing it from the ambulatory. The principal monuments of interest are a Renaissance tomb of Villiers, Duke of Buckingham, in black and white marble, occupying the center of the chapel; a perpendicular canopied monument for Bishop Sutton, and a brass of Sir Humphrey Stanley with three shields and an effigy near the entrance. On a tomb above this is a delicate fragment of carving, supposed to have formed part of a reredos to the altar which formerly existed where the monument of Lady Fane now is.

Passing up the steps to the chapel of Henry VII., the fine altar tomb of that monarch and his queen, standing in the center of the apse, is the chief object of interest. It was the work of Torregiano, and is said to have cost £1,500. The effigies are of bronze, gilt, the tomb on which they rest being of black marble, with a delicate frieze of alabaster and brass ornaments. Inclosing it is a magnificent screen of bronze, once ornamented with figure work, and exhibiting the familiar badges of Henry VII. in its panels.

Eastward, in the small chapel at the end, is the slab covering the spot of Cromwell's burial, but his body no longer rests there, having been removed two years after interment. A modern monument to the late Dean Stanley is interesting as a memorial of the present time, and for the excellent likeness of the recumbent effigy.

The chief monuments of interest in the aisles are those of Queen Elizabeth on the north and of Mary Queen of Scots on the south, well-known monuments, with good Renaissance detail and effigies.

The small chapel of St. Benedict, leading out of the south transept and in a corresponding position to that of Abbot Islip on the wall, has a large number of monuments, of which that of the Earl and Countess of Middlesex (1645), and the earlier altar tomb, with effigy, of Abbot Langham, are the best.

It will be unnecessary to enter into a detailed description of the numberless monuments in the transepts. That of Chaucer in the south transept (of Purbeck marble), and of Sir Francis Vere and of Lord Norris in the north transept (two elaborate Renaissance examples), are the most noteworthy.

The north transept, known as the "Statesman's Aisle," is crowded with a very large number of monuments that are not, perhaps, conspicuous by their beauty, but which, nevertheless, form part of the history of the Abbey. The south transept is fully explained by its name of "Poets' Corner." The west wall, next the muniment room, is known as the "Historical Side."

The nave is likewise full of monuments chiefly mural, their design being in most cases of no particular interest. One of the most recent, however, that of the late Mr. Fawcett, by Mr. Alfred Gilbert, R.A. (placed here in 1887 to the late postmaster-general), is deserving of notice as one of the most successful and original in conception of modern monuments in the Abbey, or anywhere else in this country. It is on the south wall of the south west tower.

The aisle arcading of the nave was ornamented with armorial shields of the benefactors to the Abbey during its construction. Of these, sixteen westward of the crossing were carved and painted. Four have disappeared, but those remaining are excellent examples of heraldry. The others, partially obliterated, were painted in the spandrels of the arcading, and are later in date.

Under recesses in the south walk of the cloisters are monuments of early abbots, but the names on the stones above them are of modern date, and probably incorrect. On one is a low relief effigy with pastoral staff.

The Abbey is not rich in ancient glass. The oldest portion is in the triforium of the presbytery, and consists of fragments of *grisaille* of early fourteenth century date. In the east window of Henry VII.'s chapel is a figure of the founder, and in the chapels and aisles of the same are many old quarries with initials "K. H." crowned, and badges—the portcullis, fleur de lis, etc.

The three windows of the apse were made up in 1753, with a mixture of old and new glass. The later date was found among the pieces of the new work. There are some fragments also in the windows at the west end of the aisle. The glass in the great rose window is of the eighteenth century; that in the south dates from 1814. The modern glass in the Abbey is poor in the extreme.

To sum up the architectural estimate of Westminster Abbey as whole, it may be said without fear of contradiction that its great glory lies in its interior, and that, in addition to the quality of unusual height already mentioned, great part of its effect is due in the first instance to the erection of all the more important portion of the eastern end in one style, and that the style in which Gothic architecture was at its best—when it had gained great picturesqueness and freedom while still retaining a certain reticence in ornament and a noble purity of architectural lines; and secondly, to the architectural good sense shown by the builders of the later portion of the nave in carrying on the building on the same lines as the eastern portion, with only the unobtrusive differences which arise from variations in the mouldings and some smaller details, and which are not sufficient to destroy the unity of the whole design. Had the nave been completed with that frank adoption of the style of a century later, without any regard to harmonizing it with existing work, which was usual with mediæval builders, the effect of the interior would have been by no means so striking and impressive as it now is. Externally, there is much to interfere with our enjoyment; indeed it might perhaps be said that there are few English churches of the same size and importance which impress us so little externally. The most effective view is from the southwest angle of the cloister; not adopted in the view drawn by Mr. Begg, because it is only after all a very partial view. On the north side the greater part of the exterior has been restored, as one may say, to the bone, and for the most part badly restored; the only exception being Mr. Pearson's north transept, which is one of the most remarkable examples of the revival of the mediæval spirit in modern times that could be found; and though we are averse to imitative restoration in general, there can be no doubt that the transept as it was before Mr. Pearson took it in hand was in a miserable state, and had lost almost everything of original value, and we do not quite know what better could have been done with it than has been done. The want of a central feature of some kind over the crossing is much felt; it might still be possible to supply this by a lantern of light construction. It is obvious from the design of the crossing piers that the building was not intended to have a tower at the crossing; probably this was due to the French influence under which it was erected. The upper portion of the western towers is another defect of the building, which has received praise far beyond its deserts. There is no doubt that the towers, whether designed by Wren or Hawksmoor, are admirably proportioned to the rest of the structure, and in that respect show the eye of a true architect, and when one is at a distance and cannot see the detail they pass well enough. But in detail they are wretched, and if they serve to show that their classic designer made a praiseworthy effort at Gothic detail, they also prove that he had no perception of or feeling for its true character. For our own part, we should be very glad to see them down and replaced with terminations of the same general outline and more in keeping with the style of the substructure; not necessarily an imitation of mediæval work, but something more in keeping with it. At the opposite end of the building is the only portion which, in its own style, is equally fine and perfect internally and externally, and which moreover has the interest of being peculiarly and specially English. It is not certainly in the highest style of Gothic architecture, and a severe criticism may well find fault with the busy over-elaboration of detail on every part, but it is a work carried out in every part with the highest artistic enthusiasm and striving after perfection; and it is rather a curious comment on what has been said as to the peculiarly French influence recognizable in other portions of the interior of Westminster Abbey, that a French art critic who visited England for the first time a little while since told us that he had seen nothing in all London which delighted him so much as Henry VII.'s chapel.

COLORS OF THE IMAGES OBTAINED BY THE APPLICATION OF VARIOUS ORGANIC COMPOUNDS.

Reagent employed.	Color of image obtained.	Color of image obtained by acidifying developer with hydrochloric acid.	Color of image obtained by adding ammonia to the developer.
Aniline and its salts	Green. (Whites discolored.)	Green. (Cleaner whites.)	Blue violet.
Paratoluidine	Red. Soluble in water. (Print weakens by washing.)	None.	Pale yellow.
Orthotoluidine	Green.	None.	Violet. Slightly soluble.
β Naphtholamine hydrochlorate	Black.	Brownish black.	Reddish.
Para-amidophenol hydrochlorate or sulphate	Brown. ("Photographic" tone.)	Reddish brown.	Deep violet.
Benzidine hydrochlorate	Deep blue.	Yellowish brown, becoming blue on washing.	Faint yellow, becoming blue on washing.
Toluidine hydrochlorate	Deep blue.	Reddish yellow. Soluble.	Pale yellow.
Guaiacol	Orange.	None.	Feeble gray.
Pyrogallic acid	Violet black. (Print becomes veiled.)	Pale yellow.	Deep reddish violet.
Eikonogen	Greenish.	Brown.	None.

PRINTING WITH MANGANESE SALTS.*

By R. CHILD BAYLEY.

I WOULD explain at the outset that this short account of the experiments recently performed by Messrs. Lumiere upon a printing process based upon the employment of salts of manganense, consists of a translation of two communications sent by them to the society elaborating two former papers on the subject, abstracts of which have already been published in the *Photographic Journal*, vol. xvi., p. 254, vol. xvii., pp. 55, 83, and 182, followed by a demonstration of the way in which I have been experimentally working the process lately.

The process, for which an English patent, No. 5,892, 1892, has been taken out by them, is roughly as follows:

Potassium permanganate is treated with an organic acid (preferably lactic), the first result of which is the formation of a copious black precipitate. By continuing the addition of the acid, the precipitate is re-dissolved, and a brown liquid results. To this liquid, which they believe to be a solution of manganic lactate, glucose, sodium sulphite, or some other reducing agent is added. Upon its surface paper coated with gelatine is floated, which, when dry, will be found to be sensitive to light.

The paper has a brown color, and upon exposure to sunlight gradually becomes white. Prints so obtained can be more or less "developed" by the application of one of a considerable number of organic substances, which upon coming in contact with the unaltered manganic salt give rise to a coloration, the tint of which depends upon the so-called developing substance and the condition of its application. The subjoined table mentions some substances which they have employed with their reactions, but I have not thought it necessary to give the entire list, as set forth by Messrs. Lumiere, because some of the substances named therein give practically no results. The reactions of more than one of these different substances can be combined so as to obtain an image of a color bearing a certain resemblance to those given by each of the reagents when employed alone, it being a necessary condition, of course, that the mixed compounds shall not react upon one another.

As regards the stability of the image to be obtained by the process, since these images are composed of products resulting from the oxidation of any of a large number of organic compounds, their permanence varies with the substance employed. For example, we are told that prints developed with salts of aniline are extremely fleeting, while, on the other hand, when paraamidophenol hydrochlorate is employed, they appear to be remarkably permanent. I pass round a card upon which slips developed with the compounds named thereon are mounted. The card has been exposed to the action of light, air, and moisture out of doors since October 28. The moisture has been so great that the slips have come off the card, and have been remounted (that it has been excessive you will easily see by the condition of the card), yet where the light has acted is not visibly different from the parts which were covered, except in one instance—obtained with para-amidophenol, where the color has gone a little darker. I regret that they are not half-tone prints so exposed, but I had none by me at the time.

With a view to ascertaining whether the finished print contained manganese or not, a solution of paraamidophenol hydrochlorate was made by Lumiere to react upon one of manganic lactate, a brown and but slightly soluble precipitate resulting. This precipitate was washed and analyzed, and found to contain no manganese whatever.

When the spectrum was projected upon paper sensitized with manganic oxalate, the greatest reduction was found to take place between the rays D and E, while, if the exposure be long enough, it will be found to be sensitive to the entire luminous part of the spectrum. A curve showing its sensitiveness coincides very nearly with one showing the luminous intensity, the former being slightly displaced toward the side of the more refrangible rays.

All these substances I have not tried. Those which have answered best in my hands have been aniline and orthotoluidine sulphates, prints by both of which I pass around, together with some by MM. Lumiere—as to the developers employed to produce which I can only guess. The deep blue prints are developed with orthotoluidine sulphate with a little hydrochloric acid, which seems to keep the whites cleaner; the violet prints are merely the blue ones subsequently treated with ammonia; the greens have been obtained by the use of aniline sulphate with hydrochloric acid; the red with orthotoluidine (base) and ammonia dissolved in a mixture of alcohol and water. The formula published by MM. Lumiere does not involve the use of either glucose or sodium sulphite as an aid to increased sensitiveness, but potassium formate is used for the purpose. I might mention that I have tried all three of these, the glucose and the formate with satisfactory results, but have failed entirely with sodium sulphite. This last has, in every case, reduced the manganic salt immediately upon its addition, without exposure to light.

To prepare the sensitizing solution, 100 grains of potassium permanganate are covered with two ounces of water, and, in small quantities at a time, 4½ drachms of the strongest lactic acid are added. (These are MM. Lumiere's published proportions translated into English weights and measures.) The reaction is accompanied by effervescence, and unless the flask containing the mixture be cooled in a current of cold water, and the acid added very gradually, the mixture will heat, boil over, and be lost. It should be complete in about two hours, when the result is a brown oily solution, smelling strongly of the lactic acid. From 40 to 50 grains of potassium formate, or a similar quantity of glucose (this latter must first be dissolved in the smallest quantity of water), can then be added, well mixed up, and the liquid filtered. The solution thus obtained can be applied to gelatinized paper, either by floating, brushing, or in any other way that might suggest itself to a photographer, the excess blotted off, and the paper dried in the dark. I pass round some pieces of paper sensitized a day or two ago. The solution appears to keep fairly for some days, at any rate; there is a slight crystallization sometimes.

Printing must be done under a positive, and it is said by MM. Lumiere to be, if the paper has been properly prepared, as fast as with albumenized paper. All I can say is that my paper evidently has never been properly prepared; it has certainly never been anything-like as sensitive as this. Printing is complete when the very highest lights are quite white, and development can then take place. The paper must not be washed, but plunged at once into the developer, or the latter must be quickly brushed over its surface, when the print rapidly gains in brilliancy and vigor. All that is then necessary to complete is to wash out all the soluble salts it contains, which would probably be effected in about half an hour.

The vigor of the print seems to depend on three, and sometimes four, things:

1. The vigor of the transparency from which it is made.
2. The amount of lactate in, or rather on, the paper.
3. The strength of the solutions employed to develop, and the substances therein.
4. In the case of some the coloring matter is more or less soluble, and the print is weakened by prolonged washing.

I have not been successful with rough papers, and the reason seems to be this: The action being a bleaching one, the light, even in the high lights, does not penetrate into the body of the paper sufficiently to alter the whole of the sensitive salt; consequently, when the developer is applied, there is a discoloration,

* A communication to the Photographic Society.

and the print looks muddy. This is also the case if the sensitizing solution has been allowed to soak through the gelatine into the body of the paper, as has been the case in some of the prints passed round.

A NEW AIR PYROMETER.

THIS recently patented continuous pyrometer, by Uehling & Steinbart, is based on the law of the flow of air through small apertures. When a pipe is closed at two places by partitions of thin plates through both of which a small hole is pierced, and when one end of the pipe is connected with a vacuum of a constant tension and the other end open to the atmosphere, then air is sucked by the vacuum through the apertures, causing a partial vacuum in the space between the two partitions, and a barometer connected with it shows very soon a constant tension. The same quantity of air passes through both apertures, but the volume varies according to the difference in pressure between the atmosphere and the air in the space between the two partitions; a larger volume passes through the second aperture than through the first. The proportion between the volumes passing the apertures is constant for equal temperatures; it is changed, however, as soon as the pipe is heated at either one or the other of the apertures, because the air expands by heating. According to this the barometer will show less tension, as the air is heated while passing through the first aperture, and greater tension when the temperature is increased at the second aperture, and this change in tension is used to measure the heat.*

The space between the two small apertures can be connected to different barometers at different places, *e. g.*, at the furnace and in the offices, which latter may be at a considerable distance from the furnace. The accompanying diagram shows a pyrometer built for furnace No. 2 of the Sloss Iron and Steel Company, Birmingham, Ala.

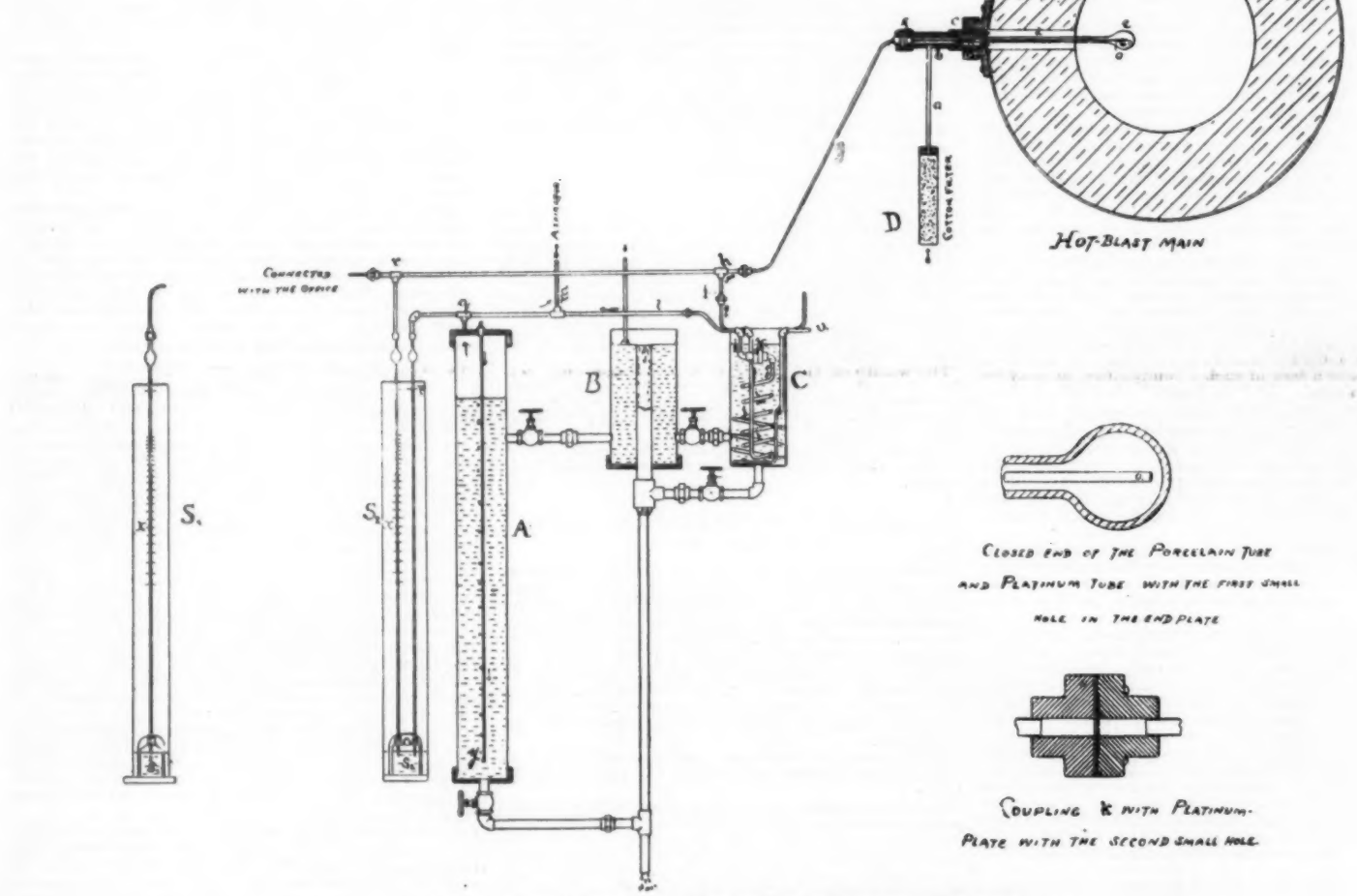
An aspirator, not shown in the cut, working by water or steam power, which is connected with the cylinder, A, by the pipe, *m*, forms the partial vacuum or suction of constant tension. The aspirator sucks always more air away than is furnished by the pyrometer. But the deficiency is supplied by the regulator, A. This regulator has only two openings; one of them is connected with the aspirator, the other is continued by a tube dipping into water to a depth of 4 feet. A valve serves to regulate the height of the water in the cylinder. As soon as the water column in the barometer tube connected to the cylinder by the T connection, *q*, rises to the height of 4 feet, the air bubbles up from the end of the tube, *y*, through the water furnishing the surplus of the air sucked away by the aspirator.

Thus the column in the barometer tube remains constant at *p*, viz., 4 feet over the level of the liquid in the Wolfs bottle S_3. Cylinder C is filled with water which is kept boiling hot by the outer of the two coils placed in it, which is connected either to the boilers or the hot blast at *u*. The vessel, B, serves to keep the water in C always on the same level and to regulate the water level in A.

The constant partial vacuum produced in the pipe, *l*, by the aspirator and the regulator, A, draws the air out of a pipe connection, which opens at the cotton filter, D, to the atmosphere. The air which is sucked in here is purified of its dust by the cotton and passes through *a* and *b*, through the porcelain tube, *d*, which is connected to *b* by the stuffing box, *c*, into the bulb, *e*, of the porcelain tube, *d*. As this bulb is inside of the hot blast main and has the same temperature as the blast, the air is heated to this temperature when it enters the platinum tube, *o*, which lies inside of the porcelain tube.

The platinum tube is closed at this end and into the end plate a very small hole is bored through which the air has to pass into the tube. The air passes back from there through the platinum pipe, *o*, the copper pipe, *g*, through the inner coil, *i i*, in the vessel, C, in which the water is kept constant, at the boiling point. Then the air passes the second small hole in the platinum plate, which is inserted into the coupling, K, and is sucked away from there through the pipe, *l* and *m*, to the aspirator. The two small apertures are shown on a larger scale at the right side on the accompanying sketch. The two barometers, S_1 and S_2, are connected with the space between the two apertures by the T connection at *h*. One of these, S_2, is placed near the furnace for observation by the stove man, the other, S_1, is placed in the office of the superintendent and is connected with the pyrometer at *r* by a copper pipe of small inside diameter.

The distance from the furnace in this case is about 325'. By this scale the reports of the stove man can be easily controlled.



THE UEHLING & STEINBART PYROMETER.

RECENT PROGRESS IN THE MANUFACTURE OF STEEL CASTINGS.

THIS was the title of a paper read at the recent meeting of the American Society of Mechanical Engineers. The author, Mr. H. L. Gantt, pointed out at the start the great difference in the product of the present day as to quality when compared with that of earlier times. The Midvale Steel Company made the first soft steel castings in the United States in 1886–1887, which were subjected to a ballistic test. Steel castings had, however, been successfully made in this country in 1867 (this date was given by Mr. Edwin H. Cramp). That year the William Butcher works made some crossing frogs of crucible steel. Castings of that day were very much honeycombed, since the use of silicon for solidifying was unknown.

In April, 1876, two small hammer dies were made, and in May a hammer head weighing 2,535 lb. Little improvement in the method was made for some time, although the quality of the steel was better. The Midvale Company then made a great step by omitting the ground pots out of the moulding mixture and washing the mould with finely ground fireclay. This mixture clung so closely to the castings that only comparatively simple shapes could be made with certainty. The next step was to use a mixture of silica sand and flour. In large castings, however, the tendency of the flour to burn, and thus leave the sand without a proper bond, proved an objection. By mixing silica sand with molasses and thoroughly grinding it, a suitable mould was obtained. In 1887 the Midvale Company made the first gun carriage of steel castings. These castings frequently had blowholes. This was obviated after a time by the use of hot metal. The author admitted that shrinkage holes and cracks still occurred; but since the steel castings had been cooled

* Supposing the law of Gay Lussac to be exact for air under different pressures, the decrease of tension for every degree of heat could be calculated as follows:

Let b_0 = the pressure of the atmosphere,
b_1 = the tension between the two plates,
b_2 = the tension of the suction,
α = the coefficient of expansion of air,
σ_1 = the specific gravity of the air entering the first aperture,
σ_2 = the specific gravity of the air entering the second aperture,
t = the difference in temperature between the first and second apertures, and the heat of the air entering the second aperture = 0, then the velocity of air passing the first hole is:

$$V_1^2 = 2g\frac{b_0-b_1}{\sigma_1}$$

and of the air passing the second hole,

$$V_2^2 = 2g\frac{b_1-b_2}{\sigma_2}$$

because the same quantity of air passes both apertures, the air being under the pressure b_0 and the temperature t at the first hole, and under the pressure b_1 and the temperature 0 at the second hole, the velocity at the second hole V_2 when both holes have the same area must be

$$V_2 = V_1\frac{b_0}{b_1}\frac{1}{1+t\alpha}$$

Substituting the values of V_1 and V_2 we have

$$\sqrt{2g\frac{b_1-b_2}{\sigma_2}} = \sqrt{2g\frac{b_0-b_1}{\sigma_1}}\;\frac{b_0}{b_1(1+t\alpha)}$$

The specific gravity σ_2 is according to the change in pressure and heat:

$$\sigma_2 = \sigma_1\frac{b_1(1+t\alpha)}{b_0};$$

substituting, we have

$$\sqrt{2g\frac{(b_1-b_2)\,b_1}{\sigma_2\,b_1\,(1+t\alpha)}} = \sqrt{2g\frac{b_0-b_1}{\sigma_1}}\;\frac{b_0}{b_1(1+\alpha t)}$$

consequently

$$b_1-b_2 = \frac{(b_0-b_1)\,b_0}{b_1(1+\alpha t)} \text{ and } b_1 =$$

$$-\tfrac{1}{2}\left(\frac{b_0}{1+\alpha t}-b_2\right) \pm \sqrt{\frac{b_0^2}{1+\alpha t}+\frac{1}{4}\left(\frac{b_0}{1+\alpha t}-b_2\right)^2}$$

Although this formula is not exactly right, it shows very well the working principle of the pyrometer. The formula indicates that the divisions become very gradually smaller and smaller as the temperature rises, but for a suction of 48 inches of water it still shows a difference of about one inch for 100° F. at a temperature between 1,200° and 1,500°, if water is used in the barometer.

Further information may be had from Alfred Steinbart, care of the Sloss Steel and Iron Company, Birmingham, Ala.

from the bottom up they are less frequent, for the founder fixes on the heaviest portion for his sink head, which is usually 20 per cent. of the total weight; this must remain fluid till the whole of the casting proper is solid.

By making a steel casting as nearly as possible of uniform thickness it has been possible to make castings 20 ft. long and 10 ft. wide. The author then proceeded to show the reason why it was easier to make more satisfactory castings when they were to be large than when a small one was required, and we may quote him in conclusion:

"Most steel castings are made by the open-hearth process, and the furnace usually melts from 5 tons to 20 tons. To pour even 5 tons of steel into castings averaging 100 lb. in weight would, as a rule, take so long that those poured last would be of inferior quality on account of the cooling of the metal. As a rule, a large portion of the heat is poured into a comparatively few large castings, and the remainder put into the smaller ones. If the metal is very hot to start with, this may give fair results, but in all cases the least desirable metal is put into the small castings.

"This difficulty seems almost insurmountable by the open-hearth process, but is readily overcome by a small Bessemer converter, from which we can get two or three tons of metal as hot as we may wish it. Add to this the fact that we can get from the converter that quantity of metal of any composition we may desire, every half-hour throughout the day, and we realize the advantage of the Bessemer process for making small and medium weight castings. The manufacturers of electric motors who have been buying their castings from open-hearth foundries have apparently not realized what the Bessemer foundry has in store for them. It seems hard to believe that perfectly solid steel castings can be made of the following composition with regularity: Carbon, 0·12 per cent.; manganese, 0·3 per cent.; silicon, 0·3 per cent.; but it is a fact. It may be noted, however, that this steel, while very well adapted to electrical purposes, is of but little value for any miscellaneous castings, except very small ones, on account of the tendency it shows to crack during the process of solidifying when cast in shapes at all complicated.

"The fact that we can make a number of different kinds of steel each day if we use a converter, and but two or three heats at most in twenty-four hours if we use an open-hearth furnace, gives a great advantage to the founder using the converter, especially if he is making all kinds of steel castings, enabling him, as a rule, to make far more prompt deliveries than is possible for the open-hearth founder doing the same variety of work.

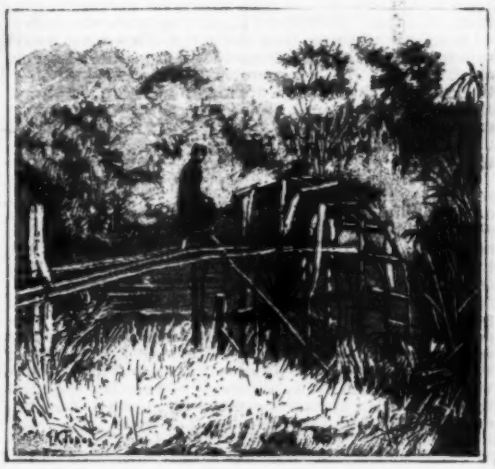
"Among the other advances made in casting steel may be mentioned one for making a casting having one or more facings of a steel much harder than the body of the casting. The process consists in lining such faces of the mould as will be adjacent to the parts of the casting it is desired to harden with a metallic alloy in a crushed or powdered state, capable of being melted and absorbed by the molten steel in contact with it, and of such a nature as to impart to the steel a hard face, or a face of such a composition as may be readily hardened. If it is desired that the casting shall have a permanently hard face and be used for stamp shoes, crusher jaws, hammer dies, etc., ferro-manganese gives the best results. If it is desired to do machine work on the face and make it extremely hard afterward, ferro-chrome is most suitable. The fact that it is possible to produce a soft steel casting, having a face that can be hardened without causing the remainder of the casting to become brittle, will undoubtedly make it possible to use steel castings in place of chilled iron in many places with great advantage."

MALACCA TIN.

PICTURES of many strange and out-of-the-way places have from time to time appeared in the *Daily Graphic*, but I cannot remember having seen any views from, or remarks upon, the Malay Peninsula. And yet in this large tract of country, now in process of being developed, live many Englishmen, whose lives of isolation are passed in content because of their engrossing task of civilizing and opening up countries formerly the scene of barbarism and disorder. Most people have heard of the large native states, Perak and Selangor, and owing to the frequent visits to England of the Maharajah of Johore, the name of that independent state is also a familiar word, though possibly it might puzzle many who have met its agreeable ruler to exactly locate his kingdom on a map.

By degrees the states of Perak and Selangor have, under British protection, worked their way upward, and there are others which, though not yet emerged from the chrysalis stage, patiently endeavor to follow in the footprints of their more matured neighbors. Of these is the tiny state of Jelebu, which some six years ago was accorded British protection at the request of the people, who wearied of internal dissensions and raids from their powerful neighbors of Pahang. The state was consequently placed under a collector and magistrate, one of the officers of the Resident of Sungei Ujong, and thus became amalgamated with that government. The policy followed in the older states has been adopted, and the English officer in charge lives alone among the people, and by gradual process accustoms them to the ways and methods of English rule.

As can be readily imagined, the life of this sole local representative of authority is not a monotonous one.



AN IRRIGATION WHEEL, MALACCA.

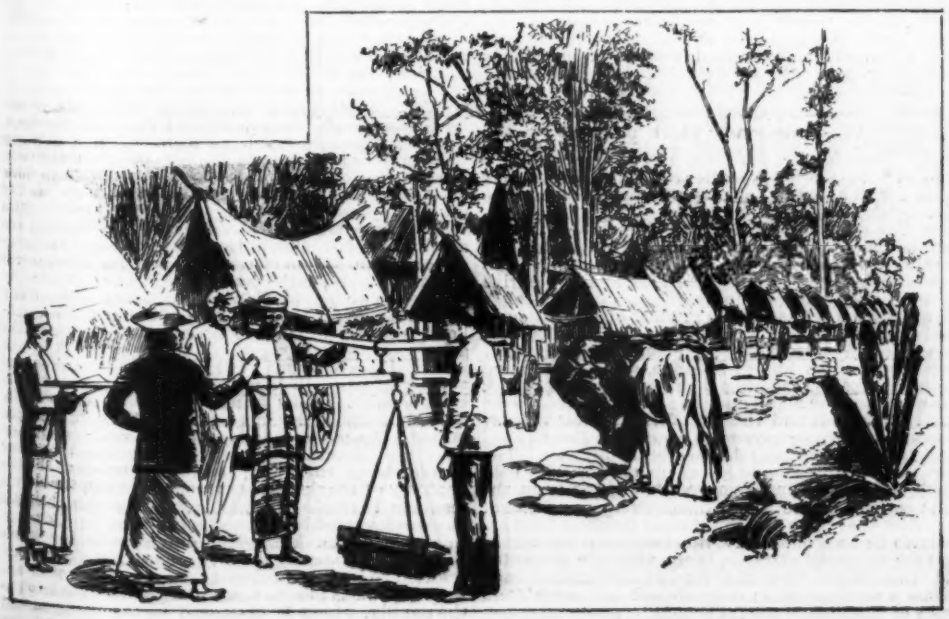
His work embraces a vast variety of interests, from exploration to education, and from the laying out of townships to the dispensing of justice, together with innumerable other duties. Were the state not under British protection, the Chinese would soon become the chief power in the country, gradually but surely ousting the idle and improvident yet delightful Malays. A Malay is almost always a gentleman, and therefore needs no further description.

The wealth of this state, as in the larger ones, consists of its tin mines, and to work these the Chinese flock thither. That these mines are being worked to some purpose is proved by the fact that in 1886, the first year of British protection, the revenue was less than $2,000, whereas it is now nearly $200,000.

One of the sketches shows the tin ore, which some people may not know has the appearance of black sand, packed in bags and being weighed at the customs office previously to export by bullock cart. Sometimes, as may be seen, the ore is smelted at the mines and exported in slabs.

Another sketch represents an irrigation water wheel, one of the cleverest things ever devised by an untaught people. This wheel, which is constructed of bamboos, is sent round by the current of the river, the water is picked up by the revolving cylinders and poured into a wooden trough at a higher level—the level of the banks—and by this means it is sent forth into the adjacent fields. Many an engineer whose wanderings have brought him so far afield has stood astonished at the sight of a contrivance so simple and so ingenious.

The scenery of this country is beautiful. The climate, though perhaps occasionally warm, is agreeable, and is moreover, for Europeans, one of the healthiest in the world. Game of all sorts abounds here, and it is a matter for wonder that in these days of travel, only a few hours' journey from Singapore, there should still remain for discovery a country of possibilities as yet unknown to the most enterprising trotters round the globe.—*Daily Graphic, London.*



MALACCA—WEIGHING TIN AT THE CUSTOM HOUSE.

ENAMEL PAINTS.

THE manufacture of enamel paints has grown to very large proportions during the past few years, the great bulk being manufactured for use by amateur painters and artists, although a very large quantity is consumed by painters for surfaces where a very high polish is required. Enamel paints, says the *Chemical Trade Journal*, are paints which, when applied to the surface of objects, leave behind a hard and very lustrous coating, very different in appearance to the much duller coat left by an ordinary paint, and therefore have a greater decorative effect. What were known as varnish paints have been common for years, but these were only used for low-class work, and not for any artistic work at all. There is no doubt but what the greatly extended use of cycles during the past decade, and the need of the owners for some paint which would dry with an enamel surface, has done much to promote the use of enamel paints.

A great variety of enamel paints can be made. They may be made so as to be cheap or dear, quick or slow drying, according to circumstances; but, however they may be made, they must possess one characteristic, viz., that of drying with a luster and with a hard surface.

This condition can only be attained by using some resin, like copal, kauri, resin, etc., such bodies being the only ones which possess sufficient luster and are capable of ready conversion into a soluble or liquid form, so that they can be spread by a brush over the surface of the object to be painted. The nature of the solvents which are used to dissolve these resins will depend upon the nature of the resin used, and also upon the character of the paint which is to be made. If it is to be a quick drier, some volatile solvent must be used; while if a slow-drying enamel is wanted, a different kind of solvent is used. Simply to dissolve the resin in the solvent is, however, not sufficient, for then only a varnish is obtained, whereas a paint is required; the difference between the two kinds of materials being that, although both leave a lustrous surface, a varnish dries with a transparent coat, underneath which the real surface of the object is visible, while a paint dries with an opaque coat, which hides the real surface of the object. To enable a paint then to do this, it must contain in addition to the resin and the solvent an opaque substance which is generally colored, which opaque body is known as the pigment. The pigment to which the color of the paint is due must have one property, that of insolubility in the solvent which is used in making the paint, or otherwise it will lose its opacity, and nothing but a colored varnish will result. Hence it is that although a large number of colored bodies are known, yet, owing to their property of solubility in solvents, they cannot be used for coloring enamel paints.

THE SELECTION OF PIGMENTS.

The best pigments to use are the mineral colors, lamp or vegetable blacks for black enamels, using a little spirit soluble aniline black when enamels are made with methylated spirit to give them a pleasant tone. Vermilion, red oxide, Indian red, and Derby red make good red pigments, vermilion and Derby red having, however, this defect, that, being heavy, they have an unfortunate tendency to settle to the bottom of the paint pot. Vermilionettes, royal reds and other red pigments made from orange lead and the eosines, do not work very well in a methylated spirit paint, owing to the solubility of the coloring matter in the spirit, still they are largely used when a bright and cheap red color is wanted. Brunswick green, emerald green, and the green lakes made from the anilines do very well for green enamels. The chrome yellows and oranges cannot be excelled for yellow and orange enamels. Brown enamels are best made from umber. White enamels are made with either lithopone, Orr's white, blanc fixe, gypsum or zinc white. White lead is unsuitable.

When quick-drying enamel paints are required, then solvents of the nature of methylated spirit, resin spirit, shale naphtha, or turpentine must be used. Shale spirits and resin spirits make the cheapest paints, while those made from methylated spirit or turpentine are necessarily dearer.

When slow-drying enamels are wanted, then they must be made of the nature of an oil varnish with melted resins, linseed oil, and turpentine, colored with the necessary pigment.

The following recipes will serve to show how these various materials may be used together to produce the various classes of enamels.

For a cheap, quick-drying enamel paint.—The base of this paint is made from common resin 30 lb., turpentine 5 gallons, resin spirit 5 gallons, and linseed oil 1 quart. This may be colored by adding sufficient of any of the pigments named above. To make this paint, it is best to break up the resin into small pieces and place them in a vessel which can be covered over to prevent the evaporation of the spirit. The other ingredients are then added and the mixture placed on one side until the resin is dissolved, stirring occasionally from time to time. It is not necessary to heat it, though heat of course will facilitate solution; but it is at the expense of the spirit, much of which will evaporate. When all the resin has dissolved, then the pigment may be added and the paint mixture sent through a grinding or mixing mill to insure thorough admixture.

The best quick-drying enamel paints are made, however, with methylated spirit as the solvent. A good base for such paints is made by taking 15 lb. of good orange shellac, 5 lb. of Manila copal, 1 lb. Venice turpentine, 1 lb. raw linseed oil, and 10 gallons of methylated spirit, mixing all together cold, and stirring well until all is dissolved. To the varnish liquid so made, the necessary amount of pigment is added. For blacks, nothing is better than 5 lb. of vegetable black and ¼ lb. of spirit aniline black. For white, add 4 or 5 lb. Orr's white. Bright reds may be made from vermilionettes or royal reds. Any of the pigments which have been named above may be used to color spirit enamel paints.

Slow drying enamel paints are best made by adding

the required amount of coloring pigment. These varnishes are made by melting gum copal for best varnishes, or kauri or resin for cheaper qualities. The melted resin is then dissolved in hot linseed oil, and to the mixture is added sufficient turpentine to thin it down to the required consistency. The varnish so made is then ready for use. For fuller details reference should be made to one of the various works which deal with varnish making, such as Hurst's Painters' Colors, Oils, and Varnishes. Opaque pigments should be used in this class of enamel paints. The aniline or coal tar colors, owing to their insolubility in oil and turpentine, are not very suitable for coloring oil varnishes, and their use is best avoided. These slow-drying enamel paints take from 12 to 24 hours to dry, according to the varnish used. They leave a good, firm lustrous coat, which, in the majority of cases, is more durable than that which can be obtained from a quick-drying enamel paint. They are, however, not so generally useful; as a quick-drying paint is, on the whole, much more serviceable for use by the public, who often desire to handle objects almost as soon as they are painted.

THE CARE OF THE SKIN.*

By JAMES C. MCGUIRE, A.M., M.D., of Washington, D. C., formerly lecturer on Dermatology at the Hospital School of Medicine, Louisville, Ky.; Dermatologist, Louisville City Hospital, etc.

THAT we may better appreciate the importance of the proper care of the skin, it is well to know something of this, one of the most important and complex organs of the body.

It is practically divided into two parts—the outer, cuticle, scarf-skin or epidermis and the deeper true skin or corium.

The epidermis is subdivided into the corneous layer, composed of flat, lifeless, colorless cells and the malpighian layer (so named from the anatomist, Malpighi) of irregular shaped cells, developing to replace those of the outer layer that have been cast off. It is these cells that contain the coloring matter that causes the difference in hue in the European and African. The true skin or corium (from the Latin *corium*, leather) is divided into the outer papillary layer, made up of little elevations called papillæ, intended to give a greater amount of surface. It has been computed that there are about one hundred and fifty millions of these over the whole body. Below this is the reticulated layer (from the Latin *reticulatus*, net like or latticed), made up of elastic interlacing fibers, the meshes of which become larger and larger, until we reach the subcutaneous tissue which connects the skin to the parts beneath.

The corium is well supplied with blood vessels, lymphatics, nerves, glands and hairs. The arteries from below send off little capillary loops, which ascend in the papillæ, then descend to become veins; they are called capillaries (from the Latin word *capillaris*, like a hair), they are so small and slender. Some of the nerves send off prolongations that become lost in the deeper cells of the epidermis. Others enter the papillæ to wind around and penetrate little bodies called tactile corpuscles. There are two varieties of glands —the sudoriparous and sebaceous. The former derives its name from two Latin words, *sudor*, sweat, and *pario*, I produce. They are made of tubes twisted in the form of a coil in the lower part of the corium, with a duct, ascending through the entire thickness of the skin, to open upon its surface. They are most numerous upon the palms of the hands, where there are about two thousand seven hundred to the square inch, or about two million three hundred and eight thousand over the whole body—an entire length of secreting tubes of two and one-third miles.

The sebaceous glands are made up of a mass of lobules, with a tube that usually enters a hair follicle. The hairs are regarded as modified epidermis. Almost the entire skin is provided with these appendages, except the palms, soles and some other parts. They receive their nourishment and growth from the hair papillæ, which they surround in the corium; occasionally they spring from the sides of the hair follicle; the total number in an average head of hair is said to be one hundred and twenty thousand. They are elastic, stretching about one-third their length, about one-four-hundredth of an inch thick, and will support a weight of two and a half ounces.

Sir Erasmus Wilson has reported the case of a young woman in whom the hairs covered almost the entire surface of the body and were thick enough to conceal the skin. Cases are reported in which the beard grew to the length of seven or eight feet. The hairs of the beard grow at the rate of about six inches in one year.

As to blanching of the hair in the course of a few hours, there are but few well-authenticated cases. In one mentioned in Flint's *Physiology*, the hairs turned white in the course of the night in a patient under observation in a hospital. The blanching is caused by the accumulation of air in the medulla and cortex of the hair. There is no diminution in the amount of pigment.

The nails, like the hairs, are derived from the epidermis. They are embedded in the skin at their lateral and posterior margins. The part under the nail is called the matrix, from which it grows. The semi-lunar shaped portion, near the root, is called the lunula. It is paler than other portions of the nail on account of having fewer blood vessels. Erasmus Wilson refers to a few "golden rules for the care of the nails. They should not be cleaned with any instrument whatever except soap and the nail brush, with an occasional use of the knife or scissors to the free end and an ivory presser to the scarf-skin at the root; when they are stained or discolored a little lemon juice is the best corrective."

So much for the anatomy of the skin. It is usually regarded simply as a covering for the parts beneath and to give shape to the form; but, as has been seen, it has functions peculiar to itself. It is an *organ of sensation*, especially of touch. This sense can be cultivated to a wonderful degree. We may see this exemplified in the blind asylums, where the inmates are taught not only to read but to study geography, botany, and anatomy by means of models through this sense alone. It has been related of a blind sculptor that he could model the most perfect likeness simply by touching the face, and of others who could even tell the color of objects in the same way.

The subject of *cutaneous absorption* is of interest, not only as a physiological fact, but from a therapeutical standpoint. A substance that has been applied to the skin and is capable of being absorbed is taken up by the orifices of the glands and follicles and between the cells of the epidermis. According to Prof. Liebrich, corrosive sublimate salve, one to one thousand, made up with lanolin, if rubbed into the skin, is so rapidly absorbed that the characteristic metallic taste, due to the absorption of the mercury, will be noticed in a short time.

As an organ of secretion, sweat is constantly poured out in the form of insensible perspiration—in amount, about two pints or pounds in twenty-four hours. It has a saline taste and alkaline reaction. Composed almost entirely of water, it regulates the temperature to a great extent by the amount that is secreted. In the functional disorder of the sweat glands known as *bromidrosis*, it has an offensive, disgusting odor that will render a patient not only a burden to himself, but repugnant to every one with whom he comes in contact. It is said of Henry IV., of England, who suffered from this affection, that the ladies of his court would faint from the offensive odor when in his presence. Prof. Hammond relates the case of a woman who exhaled the odor of violets during an attack of hysteria. In another functional disorder of the glands, known as *chromidrosis*, it may be colored black, blue or red, or it may become phosphorescent; the body then becomes luminous in the dark.

The secretion from the sebaceous glands, known as sebum, is a semi-fluid substance containing 50 per cent. of fatty matter, and is intended to give softness to the skin. The so-called "flesh worms," or "grubs," are really masses of sebum which clog up the follicles; the little black heads are caused by an accumulation of dirt and pigment.

Considering the important functions the skin has to perform and the harm that will result from the non-performance of these functions, the importance of its proper care can hardly be overestimated. It is true that "beauty usually produces love, but cleanliness will preserve it." Cleanliness is absolutely essential to the correct performance of the functions of the skin and the preservation of the general health; the dust, secretions and the cast-off epithelial scales must be removed by frequent washing. This brings us to the subject of *baths and soaps*. The ancients indulged more freely in the bath than is the custom with us; the Romans, especially, fully appreciated the pleasures and necessity of the bath, and indulged in it to excess. They erected magnificent buildings, supplied with all the requisites for hot, cold and vapor baths; from the ruins, as we now see them, we can form but an inadequate idea of their splendor; buildings, including libraries, gymnasiums and baths, were free to the public. Women have endeavored to beautify their skin by bathing in milk and scented waters. To such an extent was this carried in Paris at one time that there was great scarcity of milk for the table. I know of a well-known prima donna who uses a quart of cologne in each bath.

I do not consider the daily application of the full-length bath for hygienic purposes necessary. Twice a week is sufficient to cleanse the skin of all external *debris*; more frequently than this is simply a luxury. The average Englishman would rather part with his tooth brush than his tub; his solicitous care of it is amusing; it must always be with his luggage; he will bring it across the Atlantic; will take it to the wilds of Africa or to the plains. Why, can he go to any place where he cannot procure a better bath than his "tub" can afford? but—"well, you know, it is so English." While traveling on the Northern Pacific Railroad, Montana Territory, some years ago, I heard an Englishman ask the baggage master for his tub, that he might indulge in a bath while the train waited half an hour for dinner. When it was refused him, he simply abused the blasted country, went to a neighboring hotel and took his plunge in the public bath tub. As the train moved off he ran after it, completing his toilet as he ran. He was either a very cleanly person or an extremely dirty one.

Not only is the daily full length bath unnecessary; it is harmful in many cases, depriving the skin of its natural unction, rendering it rough and liable to take on an eczema in those who are predisposed to this disease. The Turkish bath has done as much harm as good; it is of benefit, however, in some cases to stimulate the skin and thoroughly remove all external debris; in this respect it cannot be surpassed.

The hands, face and neck should be washed at least twice a day, and such confined portions of the skin as the armpits, once; the whole body twice a week, as I have already said, is all that is necessary. It should be known that there are certain diseases of the skin, such as eczema, to which water is absolutely poisonous; cases of this disease may at times be cured by simply protecting the part, and not allowing water to come in contact with it. After a cold bath use brisk friction, with a towel, not only to further cleanse the skin, but to excite the cutaneous circulation, and so draw the over supply of blood from the internal organs. Those suffering with heart troubles should abstain from the hot bath, as the heat will cause a determination of blood to the surface and so deprive the heart of its natural supply.

Soap may be defined as the product of the action of alkalies upon refined oils or fats. If the alkali is soda, the result will be hard soap; if potash, it will be soft. Soaps are of three kinds: Alkaline, when there is an excess of alkali, rendering it more or less caustic; neutral, when the alkali and fat are supposed to be exactly balanced; and the over-fatty. Their efficacy depends upon their power of rendering the natural unguent of the skin and debris soluble in water. The soap is decomposed and gives up part of its alkali, which unites with and removes this debris from the skin; the rest of the alkali dissolves the particles of epidermis that have performed their functions and are ready to be cast off. Only the best soap should be used for the toilet—that is, those that are unscented and transparent, for the foreign admixtures may irritate a sensitive skin; they should not contain an excess of alkali, and the fat should be pure and sweet. Probably the best is either the white castile, made with the best olive oil and soda, or Pears' unscented transparent soap. As to medicated soaps, they are, as a rule, valueless, for the quantity of the drug taken up is very small; it is in contact with the skin too short a time; the amount cannot be measured or its purity guaranteed. They should never be used without the advice of a physician.

There is a popular error that soap should not be used upon the face. There is no good reason for this belief; in fact, it is more important on the face than elsewhere; not only is the face the most exposed portion of the body, but there is a greater amount of secretion here than elsewhere to catch the dust.

It has been said that country girls wash their faces with soap, and do not have acne; city girls abstain from the use of soap, and do. Though this is exaggerated, I have met with cases that have been aggravated by neglect of this part of the toilet.

There is an old saying, "Women who paint their faces to seem beautiful do clearly deface the images of their Creator;" and yet they will frequently resort to any means that hold out the least hope of improving their complexions, such as plastering their faces with paste, enameling, binding it in raw beef, and even wearing medicated masks. The purpose of most of these applications is simply to conceal repulsive blemishes, which in the majority of cases could be readily removed by appropriate treatment. Such methods can only do harm; for if they do not directly injure the skin, they make it tender and much more apt to be affected by external agencies. To make their hands white and bloodless women have been known to spend the night with them suspended by means of pulleys.

I am frequently asked, are dusting powders harmful? Most of them are, for they are liable to contain lead, bismuth or other deleterious ingredients. Plain starch, magnesia or corn starch farina are the least harmful. I advise against the use of any of them, as they will clog up the openings of the glands, and so are apt to prevent them from performing their proper functions. If the face is abnormally greasy, a little sulphate zinc, in water and alcohol as a lotion, will be found of benefit.

Hair Dyes.—As a rule these dyes will not act injuriously, except when they come in contact with the scalp itself, when they may cause some irritation. Black color may be produced by painting in a solution of nitrate of silver, and then exposing the hairs to the sunlight; to avoid staining the surrounding skin it may be washed with a solution of common salt. Prof. Kaposi mentions a hair dye that has been in use very generally in the East, among the Persians. It will produce all shades of color, from a light brown to dark black. "The remedy consists of the powder of the dried henna plant and of the powdered indigo plant. The first powder is formed into a thick paste by means of water, and spread on the hair; after the lapse of an hour this appears of a red color. A paste prepared from the powdered indigo plant is then spread on the first. Under the influence of warmth and moisture the black color becomes apparent on the hairs, covered with these two pastes, in the course of several hours. We have seen, even in the experienced hands of Dr. Pollak, a color produced which was some degrees removed from what was desired." Before beginning the use of hair dyes, read the experience of Tittlebat Titmouse, in Warren's "Ten Thousand a Year."

Hair Restorers.—The Massachusetts State Board of Health has had a large number of so-called hair restorers now in the market analyzed. It was found that all that were examined contained lead in varying quantities. For *falling of the hair*, our chief reliance must be in the use of local stimulating applications. Equal parts of tincture of cantharides and bay rum is an excellent application; it will not blister the scalp. The confidence with which a bald-headed man will use a hair restorer, recommended by a bald-headed barber, has been referred to as a sublime example of faith cure. It is of especial importance that the hygiene of the hair should be looked after—that is, the proper use of the shampoo, brushing, exposure to air and light, cutting and shaving, and in the use of pomades. *Shampooing* should be resorted to about once a month. The best shampoo is made of equal parts of saponis viridis and bay rum; it should be about the consistency and color of sherry wine. As it is frequently made up in the shops, it is a dark thick fluid, caused by the use of an inferior quality of soap. The mistake should not be made of applying the shampoo to the hairs alone, but the hairs should be separated and the liquid dropped upon the scalp, here and there, and then with the use of a little water rubbed thoroughly for five or ten minutes. Usually the shampoo is not applied with sufficient vigor. The hair should be dried and an ointment, such as sulphur, one drachm to the ounce, applied. *As to brushing*, a good stiff *brush* should be chosen, such as recommended by Dr. Jackson. "A properly made brush has its bristles placed in little clumps or groups in such a manner that the little bristles of each group are larger than those of the periphery. The bristles are well set into the back of the brush and the groups are wide apart." With such a brush the hair can hardly be brushed too much. Not only should the fine tooth comb be interdicted, but any form of comb is bad for the scalp; it is not necessary, as the part can be just as well made by means of two brushes. Wigs and false hair heat and sweat the scalp, and deprive the hairs of the sunlight and air which are necessary to their healthy growth.

Hirsuites.—Women suffering from an abnormal amount of hair will resort to any means to get rid of this blemish. They usually shave or extract the hairs, but this only acts as a stimulant to renewed growth. So-called depilatories are worse than useless; they contain ingredients that have the power of dissolving the hair; but, if we remember the anatomy of the skin, it is evident that it is impossible for them to reach the papillæ, from which the hair receives its nourishment, without destroying the whole thickness of the skin. The only means by which the hairs can be permanently removed is the method resorted to by dermatologists, known as electrolysis. A fine needle is inserted into the hair follicle down to the papillæ, which is destroyed by the passage of an electric current from the negative pole of a galvanic

* From the *Virginia Medical Monthly*.

battery. Five thousand hairs have been removed from a lady's face by this means, resulting in permanent relief of the trouble.

Lotions for the toilet, as found in the shops, are liable to contain mercury. This may be absorbed and produce symptoms of constitutional poisoning. What is known as "flake white" is made by mixing carbonate of lead with rose water. Cases are not infrequently reported of women, who have been poisoned, showing symptoms of the constitutional effects of the lead. Some of the symptoms are delirium, abdominal pain, a peculiar drop of the wrist, and a characteristic blue line along the edge of the gums.

Some Popular Errors in Regard to Skin Diseases.—Though many of our colleges completely ignore the study of dermatology, the leading universities have awakened to the fact that it is a subject not to be neglected, and examinations are now even made compulsory. It is just as important to make a correct diagnosis between an eczema and psoriasis as it is between scarlet fever and measles, variola and varioloid. It is presumable that the study of cutaneous diseases is neglected to such an extent on account of their unimportance; but in refutation of this, one has only to refer to the literature of the subject; to such books as Hebra's Diseases of Skin, in five volumes, of three or four hundred pages each; to recall such names as Hebra, Kaposi, Neuman, of Vienna; Sir Erasmus Wilson, Tilbury Fox and Addison, of England; Bulkley, G. H. Fox, Morrow, Piffard, White, Hyde, and a host of others in this country—men who have devoted their life study to this subject, and who have no superiors in any branch of the medical profession.

Familiar appellations for skin diseases are not confined to the laity. The most diverse, ridiculous and unmeaning terms have been applied to these affections, such as *tetter*, that usually refers to eczema, or may mean psoriasis or lupus. *Bakers' itch, grocers' itch, milk crust, tooth rash*, are also used to designate some form of eczema.

Liver spots may refer to chloasma, a pigmentary affection, or to tinea versicolor, a vegetable parasitic disease.

The itch, to scabies, a disease caused by an animal parasite, known as the acarus scabiei. The expression, *army itch*, would lead one to suppose that it was distinct from scabies, yet we recognize it as the same disease.

Blood boil has no scientific meaning and is applied to various diseases.

Hives is recognized by some as urticaria; by others as varicella (chicken pox).

Shingles means herpes zoster, an acute disease, characterized by an eruption of groups of vesicles upon an inflamed base along the course of certain nerves.

Prickly heat usually refers to a disease known as miliaria, an affection of the sweat glands.

Dandruff, to the dry form of seborrhœa of the scalp.

Black heads (flesh-worms), to comedo, a collection of sebaceous matter in the distended sebaceous glands. The little black heads are caused by the accumulation of dust and pigment.

Ringworm is a vegetable parasitic disease, caused by the trichophyton fungus, and is known as trichophytosis.

Barbers' itch is caused by this same fungus upon the bearded portion of the face, and is designated by the term tinea sycosis.

Fish skin disease is a congenital affection characterized by dryness and scaling of the skin. Its proper name is ichthyosis.

Chap is usually a mild form of eczema, attended with cracking of the skin.

As to the etiology of skin diseases, how often we hear the expression, *bad blood*. Has this term any meaning? If it has, it must mean a depraved state of the blood that can be recognized by chemical reagents or by the microscope; but Prof. Bulkley says "Chemical and microscopical studies fail to show there is bad *blood* in any of the diseases of the skin. It is supposed the impurities in the *bad blood* find exit through the skin, and in so doing take the form of an eruption; consequently it is harmful to remove them. Patients frequently express themselves as very solicitous about the sudden cure of a skin disease. The consequence, in their opinion, might be disastrous by the *driving in* of a disease that might attack some internal organ. Nothing could be more absurd, for it is absolutely impossible, in this sense, to either drive in or drive out a skin disease. The blood has little to do with these diseases. There are affections as peculiar to this organ as to any other, entirely localized, depending upon changes in the tissues themselves. Others are caused by parasites; still others by nervous disturbances. It is evident that the much lauded *blood purifiers*, for cutaneous diseases, are, to say the least, useless. A patient may get well while taking these quack nostrums; the fact is then extensively advertised. This is about on a par with the announcement of lottery companies of the fortunate individuals who have obtained prizes. The tens of thousands who are not so fortunate are never heard from."

The majority of skin diseases are regarded as contagious, and the fear is expressed that those who come in contact with the afflicted are liable to become affected; but this is far from the truth, for out of the hundred and more diseases that may affect this organ, only two or three, besides the parasitic diseases, are really contagious.

As there are so many popular errors in regard to cutaneous diseases, the following *aphorisms* may be of some interest. The statements are made either upon the evidence of well recognized authorities or as a result of my personal experiences:

I. You cannot be successful in treating diseases of the skin without a thorough knowledge of general medicine. This, I think, will be accepted as a self-evident proposition.

II. You cannot cure them too quickly.

III. If they are cured, they will not act deleteriously upon any internal organ. Hebra says: "Our warmest edeavors are to find means of terminating these diseases as speedily as possible. Were we only in possession of remedies which produce cures thus rapidly we should have no anxiety in regard to the appearance, from this cause, of metastasis, or of any other consecutive disease."

IV. Arsenic is not a specific for cutaneous diseases; in fact, it is less frequently used by those who have made a special study of these diseases than by the general profession.

V. You cannot drive in or drive out diseases of the skin. "At this day no educated physician believes in employing medicine with a view to either the so called 'driving out' or 'driving in' of a disease of the skin."—*Hyde.*

VI. The great majority of these diseases, contrary to the general idea, are not contagious; only one or two, besides the parasitic diseases, out of the hundred and more that may attack this organ.

VII. Freckles are not always produced by the sun's rays. Cases are reported where they have appeared upon the portions of the body of young girls that have never been exposed to the direct rays of the sun.

VIII. Tinea tonsurans (ringworm of the scalp) does not occur in adults, though Tilbury Fox has reported one such case. If it ever occurs, it is extremely rare. Neither Duhring nor Piffard ever met with a case.

IX. Tinea versicolor, another parasitic disease, does not occur in childhood. "Children are exempt."—*Weyl* and *Gaber*. Neither Duhring nor Liveing ever saw a case.

X. Acne does not occur in childhood. Mild cases of this disease are not the easiest to cure.

XI. Chloasma (liver spots) never occurs before puberty. The disease is not caused by diseases of the liver.

XII. Bromidrosis does not necessarily mean bad-smelling sweat. The odor may be that of violets or pineapples.

XIII. Scabies and tinea versicolor do not appear upon the face of adults.

XIV. Eczema marginatum is not an eczema, but is a parasitic disease.

XV. Leprosy, as we now understand the disease, is not described in the Bible. Leprosy is not as dangerous to the community as tuberculosis, according to Beaven Rake, Superintendent of the Trinidad Leper Asylum. It is not proved that the disease has been conveyed by vaccination.

XVI. You cannot cure an eczema (tetter) by internal treatment alone. Hyde says, once fully persuaded of this important truth, the physician should be capable of managing the complaint without mental bias.

XVII. Do not apply water to an eczematous surface, as a rule. It is poisonous to acute eruptions.

XVIII. Do not expect the same effect in different persons from the same prescription; that which is of benefit in one case may aggravate an eruption in another.

XIX. Do not use a sponge in making applications to the skin. It cannot be kept clean and pure.

XX. Depilatory remedies cannot permanently remove the hairs without scarring the skin.

XXI. Pruritus does not simply mean itching as a symptom; it may refer to an idiopathic disease that is known by that name.

XXII. Bad blood is not the chief cause of cutaneous diseases; according to most authorities, it can hardly be classed as an etiological factor.

XXIII Scales and crusts are not synonymous terms.

XXIV. Drug eruptions are not due to "salivation of the system" with the drug. A few grains of iodide potash may cause an eruption as well as a hundred.

Idiosyncrasy has been defined as an individual peculiarity which renders one susceptible to certain effects not produced in others. In this way, every one is susceptible to certain ill effects from certain foods; therefore those things which your stomach has taught you it will not digest should be avoided. Shell fish, strawberries, oatmeal, etc., have been known to produce urticaria. Confectionery may aggravate an acne or an eczema. It is well to remember to keep the teeth in good condition; to have regular hours in partaking of food; not to eat to excess; never to dine alone; to eat slowly and chew thoroughly. Though it is impossible to lay down any fixed precepts of diet, there are certain articles that should be avoided by those suffering with cutaneous diseases.

PERMITTED.	TO BE AVOIDED.
Water plentifully *between* meals; cup of very *hot* water before breakfast; small amount bottled table water at meals; one cup of coffee or tea, well diluted, for breakfast; milk *ad libitum* if it agrees.	Stimulants, especially fermented; liquors; all beer, wine, cider, etc.; all fried articles; salted meats, pork, veal, lobster, cooked oysters, crabs, eggs, except boiled, sausage, potted meats, rich gravies and soups, uncooked vegetables, cabbage, corn and turnips, pastry, confectionery, preserves, nuts, cheese, rich salads, pickles, desserts, hot bread and cakes, melted butter and buckwheat cakes.
Fresh fish and raw oysters; beef, lamb, mutton, chicken, turkey, fresh game, boiled eggs.	
Cooked vegetables and fruit in season; cold bread, toast and crackers, crushed wheat, hominy and rice.	
Tobacco in moderation to those accustomed to its use.	

THE METHODS OF TESTING FATS AND OILS.*

By DR. ERNEST MAILLIAU, Director of the Government Testing Laboratory at Marseilles, France.

THE French government and the Regency of Tunis have taken the opportunity of the great American World's Fair to bestow upon us the honor to communicate to you by conference and by practical experiments the analytical methods which we use in France to recognize the purity of the fatty bodies. I hope that you will give us your kind indulgence and facilitate our modest efforts with the good will which you have already shown to all our fellow countrymen who have come to you with the disinterested object of strengthening the scientific bonds which unite the two republics.

If the French and Tunisian governments have chosen me for their representative, it is only because I direct the ministerial laboratory of technical tests founded for the purpose of studying all the products of the colonies and Mediterranean district, and especially oils and fatty matters, as well as the different products which are connected with them, and that I have acquired some knowledge of the subject by long practice and continual investigations.

This is the only laboratory of its kind, and has been placed at Marseilles, the great seaport of France and port of entry for colonial products.

* Read at a special meeting of the Chemical Section of the Franklin Institute, June, 1893.—*From the Journal.*

The difficulties of chemical analyses of fatty matters are greatly increased, not only by the slight differences which characterize the various glycerides, but also by the numerous cases of isomerism, and the phenomena of oxidation and fermentation, which modify their molecular structures, by the resins and the essential oils which they contain, and also by the foreign matters which injuriously affect them, and the composition of which varies infinitely according to the nature of the soil from which the plant draws nourishment, by the method of extraction, age, and a thousand other causes needless to mention.

Since the methods of communication have been facilitated, and exchanges have become more numerous, the different markets of the world have been flooded with fatty matters presenting different characters, though of the same nature as those to which industry and commerce have been accustomed.

We have been led to seek methods of analysis for oils not by their impurities, which vary according to their origin, but by the examination of their principal constituents, which remain practically the same for the same species.

For example, it is now well known, and we state with pleasure, since we have made the first of these observations, that the olive oil of Tunis, Morocco and other provinces often presents the character of adulterated oils if analyzed without proper precautions or by old processes.

Accordingly, the greater number of governments and large companies have been obliged to modify their specifications to control the purchases necessitated by their wants by methods better adapted to the needs of commerce and the progress of science. Accordingly, before trying the action of chemical reagents upon this product, so extremely variable and alterable, it is indispensable for obtaining precise results to submit the material to a purification preceded and followed by a number of filtrations. By thus removing the impurities which when present alter the results, we bring back the fatty bodies of the same species to a type which is always practically the same. To reach this end we work sometimes by washing with hot distilled water, sometimes with strong or dilute alcohol, sometimes we refine the fatty matter by the use of caustic soda lye (containing ten per cent. sodium hydrate), employed in the proportion of ten per cent. of the fat. The emulsion is poured upon a saturated solution of sodium chloride, and by the action of gentle heat the different parts separate and the clear oil holding in suspension insoluble particles of soap rises quickly to the surface.

It is well to note that fatty matter, even when neutral as has been demonstrated, dissolves notable quantities of alcohol, which must be eliminated, if this method of washing has been employed. The process of the operation cannot be fixed definitely; it varies according to the nature of the impurities and the object of the research.

It is certain, for example, in determining the amount of volatile acids, we must be content with the simple filtration, and that when examining the oils of the cruciferæ we must not use caustic soda, which changes organic sulphur to a soluble sodium sulphide. Having finished the preliminary operations, we may, according to circumstances, operate directly on the neutral fat or the fatty acids prepared from it.

The fatty acids collected in the nascent state (that is to say, when they rise to the surface in a pasty mass) have much stronger chemical affinities than when melted and dehydrated. This difference is particularly remarkable in the examination of cotton seed and sesame oils. The black and red colorations obtained very clearly with a mixture of five per cent. upon the nascent fatty acids are not visible with the same fatty acids when melted.

The purification skillfully made does not destroy the chemical characters of the oil, as is easy to verify, by treating comparatively the same oil containing five per cent. of the fatty matter, the presence of which we wish to demonstrate. The reactions of the added material are in general intensified by these different treatments.

By working upon the fatty acids of the neutral oils, I have been able to demonstrate the purity of certain fatty matters which appeared adulterated and in which the presence of cotton seed and sesame oils was indicated by the old methods which I have been able to revise.

(*Circulaire du Ministre de la Marine Francaise*, en date du 26 Juillet, 1892. *Rapport du Resident-general de Tunisie*, en date du 9 Mai, 1892. *Circulaires des Ministres du Commerce et de l'Agriculture*, etc.)

I well know that in practice these preliminary operations may appear very tedious, but I do not advise their use except in cases where adulterations have been indicated by the usual methods, and it is desired to make the proof positive.

Besides, I cannot understand why a chemist has always been expected in the analysis of such delicate materials as fats to discover an infallible reagent, a single drop of which will immediately turn olive oil green, peanut black, sesame red, etc., so that any inexperienced person could discover adulteration and bring the perpetrator to justice. This requirement of the most difficult part of verification is absolutely incomprehensible and is only to be excused by the ignorance of those who ask it.

We will now proceed to the study of each oil in particular. We will pass rapidly over those which possess only a secondary interest, so as to lay greater stress upon those which are the object of a great number of sophistications, as for example olive oil. But in the first place we will indicate rapidly the general processes, physical and chemical, which are used for the identification of the various fats.

GENERAL METHODS.

(1) *Specific Gravity.*—Specific gravity is taken with accuracy by the Mohr balance, which is too well known to need description. It must be borne in mind that the specific gravity of the same fat varies greatly with individual samples, and this physical character is not sufficient to allow us to decide on purity or adulteration.

(2) *Action of Nitrous Fumes.*—We owe to a Marseilles gentleman, M. Poutet, the first serious proposition for recognizing certain adulterations of olive oil.

It was designed especially to discover the presence of poppy seed oil, with which at that time olive oil was very frequently adulterated, and for which the process gave good results.

It is based upon the transformation of the olein to its isomeric modification elaidin, by the action of nitrous fumes. It has been modified by other chemists, Messrs. Boudet, Faure and Cailletet. The process of Mr. Cailletet was most sure and simple, and we use it in the following manner:

We take a tube 10 cubic centimeters long, $2\frac{1}{2}$ cubic centimeters wide, in which are 30 cubic centimeters of the fat to be analyzed. Six drops of pure sulphuric acid at 66° B. are added, the tube shaken one minute and then nine drops of nitric acid C. P. 40° B. are added, after which the tube is again shaken and then plunged in boiling water, where it is left exactly five minutes, after which it is cooled in a water bath at 8° to 10° C., whence it is taken at the end of two hours, and the condition of the mass observed. It is well to note the different colorations obtained. First, after the addition of the sulphuric acid; second, after the addition of nitric acid; third, after the removal from the water bath; and fourth, after chilling.

(3) *Sulphuric Saponification.*—M. Maumene proposed to observe the rise of temperature produced by rapidly mixing sulphuric acid with oil. The manner of applying the process in our laboratory is as follows: Fifty grammes of the fat for analysis are weighed into a conical glass of 100 cubic centimeters capacity. The temperature is noted, and ten cubic centimeters sulphuric acid, 66° B., at the same temperature as the oil, is added. The two liquids are stirred together for one minute. An accurate thermometer is then immersed in the upper portion of the mass, stirred slowly, and the maximum temperature noted. The initial temperature must be at least 20° C. In order to obtain exact results, it is well to make several determinations and take their mean when the variation does not exceed 2° C.

To obtain the relative sulphuric saponification, we note the rise of temperature obtained with fifty grammes of distilled water at the same temperature as the oil and ten cubic centimeters of the same sulphuric acid. The number of degrees obtained by the oil is multiplied by 100 and the product divided by the number of degrees obtained with water. This process has the advantage of giving results nearly constant with acids of somewhat different strength. I have tried the application of the sulphuric saponification with semi-solid vegetable oils by working at 2° or 3° above their melting points, and the results have been very satisfactory, especially for palm nut oil and cocoanut oil, because the differences between them and the fluid oils often amount to 45° or more as, for example, between palm nut oil and sesame oil.

(4) *Iodine Number.*—In the fatty bodies there are members of unsaturated series, as, for example, oleic acid, which can absorb into its molecule as many atoms of the halogens as there are lacking atoms of hydrogen for complete saturation. The iodine number of olive oil varies between 80 and 84, that of peanut oil is 97, while that of cotton-seed oil is 108. These differences then allow, within certain limits, the determination of the purity of the various fats. We apply the Hubl method as follows:

Solutions required:

Alcoholic solution of iodine.....	50	gr.
Solution of hyposulphite of sodium..	24·8	" per liter.
" " mercuric chloride.....	60	" "
" " potassium iodide	100	" "

Five grammes of fatty acid are weighed out, diluted to 100 cubic centimeters with alcohol 92 per cent.; ten cubic centimeters of the solution are taken and to it added 20 centimeters of the iodine solution and 15 to 20 cubic centimeters of the solution of mercuric chloride. The flask is closed and allowed to stand three hours. Twenty cubic centimeters of the potassium iodide solution are added and the excess of iodine titrated. When the brown coloration begins to disappear, a few drops of starch solution are added and then hyposulphite until color disappears.

We will pass in silence the other indices, such as that of acetyl, which is of use only to discover castor oil.

(5) *Freezing Point.*—The freezing point is easy to determine by means of a thermometer and a freezing mixture.

(6) *Melting Points of Fatty Acids.*—The dry and melted fatty acids are sucked into a capillary tube. After solidification the tube is placed beside the bulb of a sensitive thermometer and immersed in a beaker of water, the temperature of which is raised very slowly.

The reading of the thermometer is taken the instant the body passes from the solid to the liquid state.

(7) *Solidification Point of Fatty Acids (Titer).*—The dried and melted fatty acids are placed in a tube 15 centimeters long and 2 centimeters in diameter, which is suspended in a wide-mouthed bottle with a perforated stopper. A thermometer graduated to tenths is inserted so that the bulb reaches the center of the material. At the moment solidification commences a circular movement is given to the thermometer, stirring the whole mass; the thermometer is then left at rest and carefully watched till the mercury ceases to rise; the reading then taken gives the point of solidification, or titer, conventionally adopted.

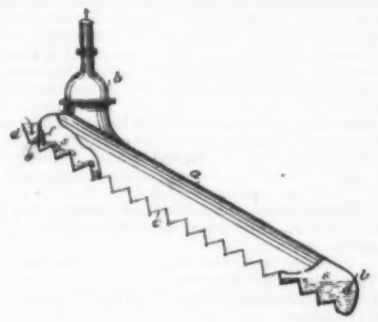
(8) *Saturation.*—We operate on five grammes of the melted and dried fatty acid with a solution of normal caustic soda. The number of cubic centimeters absorbed gives the saturation number.

(9) *Solubility in Absolute Alcohol.*—We determine this in the following manner: The fat is neutralized by agitating in a closed separating funnel for thirty minutes with twice its weight ninety-five per cent. alcohol. After settling it is drawn off and the alcohol held in solution driven off at low temperature, after which it is agitated at 15° C., or at a few degrees above the melting point; or if solid at 15°, with twice its weight of absolute alcohol. A known quantity of this alcohol is evaporated, the residue weighed and the quantity of oil dissolved by 1,000 grammes of alcohol is calculated.

(To be continued.)

"CASCADE" PLATINUM CONCENTRATING STILL FOR SULPHURIC ACID.

IN the design of platinum concentrating stills, the chief point to be aimed at is a thin layer of acid distributed over a large heating surface. In the apparatus illustrated, which has been patented by G. Siebert, of Hanau a/M., this is effected by an inclined still, the bottom of which consists of a series of steps. The acid enters at *d*, and flowing down the stepped bottom passes out at *i* into a cooler. The effect of the steps is threefold: first, it spreads the acid evenly over the whole width of the still; second, it gives a largely increased heating surface for the same length of still; and third, it causes the gradual concentration of the acid, each step forming a separate concentrating pan, with the effect that the loss of platinum during working is reduced, as the highly concentrated acid only comes in contact with the lower part of the still.



At the chemical works of H. Blank at Hankelsablage, Konigs-Wusterhausen, the following results have been obtained in 24 hours at the normal rate of working:

5,000 kilos.	Acid of 97 per cent. H_2SO_4.	Distillate 40°—45° B.
6,000 kilos.	Acid of 96 per cent. H_2SO_4.	Distillate 35°—40° B.

and with forced working,

8,000 kilos.	Acid of 95 per cent. H_2SO_4.	Distillate 20°—25° B.
9,000 kilos.	Acid of 94 per cent. H_2SO_4.	Distillate 18°—20° B.
11,000 kilos.	Acid of 93 per cent. H_2SO_4.	Distillate 12°—14° B.

all at 15° C.

With a production of from 8,500 to 8,600 kilos. of sulphuric acid containing 93 per cent. to 94 per cent. monohydrate, in 24 hours, the coal consumption was 14 per cent. of the weight of acid produced.

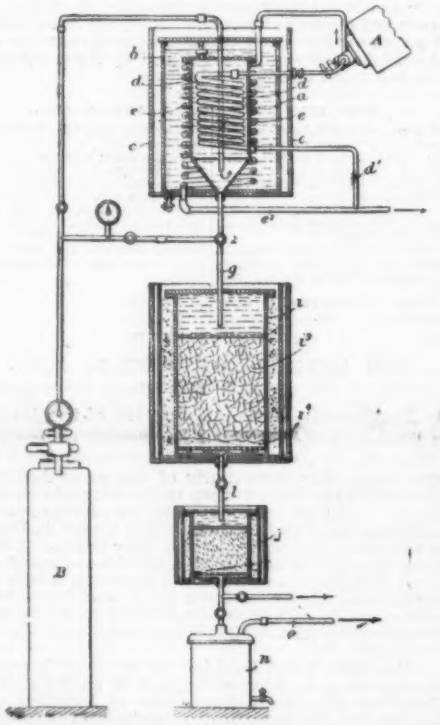
Further figures are given, comparing the Cascade still with those of Delplace and Prentice.

The loss of platinum after concentrating 242,687 kilos. of acid was too small to be determined. The still weighs 23·6 kilos., and is 1·55 m. long by 50 cm. wide, the fall being 25 cm.—*Chem. Zeit.*

APPARATUS FOR SEPARATING DISSOLVED SUBSTANCES WITHOUT EVAPORATING THE SOLVENT.

C. WEITENKAMPF, Berlin, Germany.

THE principle of the invention consists in the application of great cold to the solution to separate the dissolved substance, and afterward allowing the mixture to run through layers of filtering substance to retain the separated substance, the pure solvent running away. The figure shows the apparatus in sectional



IMPROVED SEPARATING APPARATUS.

elevation, where *a* is the reservoir enveloped by a larger reservoir, *b*, which in turn is surrounded by a casing, *c*, packed with sawdust or other suitable non-conductor. The reservoir, *b*, contains a suitable cooling mixture, and both *a* and *b* are traversed by worms, *d* and *e*, through which carbonic acid is passed from the holder, A, the outlets, e^1 and d^1, running away to a cistern. Carbonic acid is passed into the solution in *a* from the holder, B, until the liquid is saturated, the tap 2, is then opened to permit the saturated liquid to enter the jacketed filtering vessel, *i*, containing the filtering medium, which consists of a mass of charcoal, i^2, upon a layer of wading, i^3. The purified solution, after passing through the first filter, is led into a second similar filter, *j*, by the pipe, *l*, to effect a further purification, the pure solvent being finally received into the holder, *n*, while the carbonic acid gas is led away by an outlet pipe, *o*, for use over again.

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